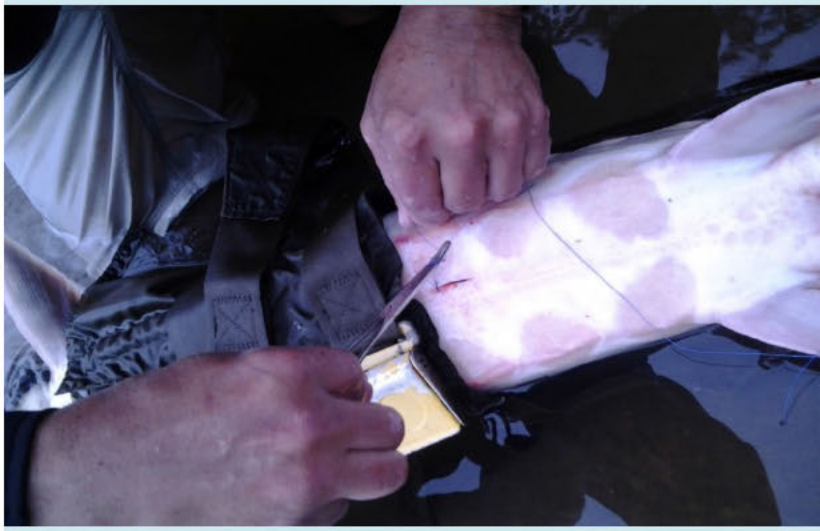
Final

Telemetry Tracking of Atlantic Sturgeon in the Lower Chesapeake Bay: Annual Progress Report for 2014

Submitted to:

Naval Facilities Engineering Command Pacific under
Contract No. N62470-10-D-3011, TO19,
Issued to HDR Inc.

NAVFAC
Naval Facilities Engineering Command



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June 2015

Suggested citation:

Hager, C. 2015. *Telemetry Tracking of Atlantic Sturgeon in the Lower Chesapeake Bay: Annual Progress Report for 2014*. Submitted to Naval Facilities Engineering Command (NAVFAC) Atlantic, Norfolk, Virginia, under Contract No. N62470-10-3011, Task Order XE19, issued to HDR Inc., Norfolk, Virginia. Submitted by Chesapeake Scientific, LLC, Hampton Roads, Virginia. 1 June 2015.

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TELEMETRY TRACKING OF ATLANTIC STURGEON IN THE LOWER CHESAPEAKE BAY

2014 DRAFT ANNUAL REPORT

Contract # N62470-10-D-3011, Task Order CTO XE19

Submitted to:

NAVFAC Atlantic
Norfolk, Virginia

Issued to:

HDR Inc.
Norfolk Virginia

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June 2015

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ACRONYMS AND ABBREVIATIONS

ACT	Atlantic Cooperative Telemetry Network
ASMFC	Atlantic States Marine Fisheries Commission
CBBT	Chesapeake Bay Bridge-Tunnel
DPS	Distinct Population Segments
ESA	Endangered Species Act
km	kilometer(s)
m	meter(s)
mm	millimeter(s)
Navy	Department of the Navy
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Association
PIT	Passive Integrated Transponder
USFWS	U.S. Fish and Wildlife Service
USCG	United States Coast Guard
VCU	Virginia Commonwealth University
VIMS	Virginia Institute of Marine Science
YOY	young-of-the-year

For regions:

Chick.	Chickahominy River
Ches.	Chesapeake Bay
Eliz.	Elizabeth River
Pam.	Pamunkey River

For military zones:

NW/Ch.	Naval Weapons/Cheatham Annex
NSN	Naval Station Norfolk
Range Sur.	Naval Firing Range off of Dam Neck

For political lines:

COLREGS	Collision Regulation Line. The political regulation line that divides inland from coastal waterways as set forth in the International Regulations for the Preventing Collisions at Sea, 1972 is COLREGS.

1. ABSTRACT

HDR/Chesapeake Scientific was funded by the United States (U.S.) Department of the Navy (Navy) to conduct a multi-year tracking study to examine occupancy patterns of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) within the lower Chesapeake Bay, with an emphasis on zones of military importance. The overarching goal of the study is to define occupancy and migration patterns so the Navy can conduct a more informed assessment of their activities' potential impacts on Atlantic sturgeon. The objectives of the study are to define migratory pathways, behavior, and periods of residency of the Atlantic sturgeon. Results are directly applicable to Endangered Species Act (ESA) Section 7 consultations and National Environmental Policy Act (NEPA) requirements, as well as numerous other environmental policy decisions. More than 75 VEMCO® VR2W receivers were deployed strategically in arrays to cover military zones, as well as regions of biological significance, within the York River watershed, Hampton Roads, the Elizabeth River, the mouth of the Chesapeake Bay, and nearshore Atlantic waters. The military zones of interest monitored within these regions were the Naval Weapons Station Yorktown and Cheatham Annex zones (York River region), Naval Station Norfolk zone (James River region), Elizabeth River zone, Little Creek zone, and Fort Story zone (both in the Chesapeake Bay region). In addition, a large zone just north of the Naval Firing Range off Dam Neck, referred to as the Dam Neck zone (Atlantic region) or Naval Firing Range Surrogate zone, was established. During the period from December 2012 to January 2014, 653 Atlantic sturgeon were detected, which represents approximately 39–48 percent of the Atlantic sturgeon population tagged with transmitters. Sturgeon detected were originally tagged in Virginia, Maryland, Connecticut, the New York Bight, Delaware, North Carolina, South Carolina, and Georgia, and were of varied life stages. Residence by sturgeon of diverse ages and origins demonstrates the importance of Virginia waters to the species. The military zone with the largest total number of detections (86,904) and detection days (585) was the Naval Station Norfolk zone which was covered by 11 receivers. The total number of receptions within Little Creek (40,234 detections on 7 receivers), Fort Story (17,551 detections on 4 receivers), and the Naval Firing Range Surrogate (10,933 detections on 14 receivers) zones were of the same order of magnitude, but the second largest number of detections was half that recorded within the Naval Station Norfolk zone. Detections at the Naval Weapons Station Yorktown and Cheatham Annex zone (6,583 detections on 4 receivers) and Elizabeth River zone (2,196 detections on 4 receivers) were an order of magnitude lower. Lower detection volume and number of fish recorded in the Elizabeth River likely reflect its reduced use as habitat. Numerous fish that use the Naval Station Norfolk zone have the opportunity to enter the Elizabeth and do not. The reduced number of fish detected within the Naval Weapons Station Yorktown and Cheatham Annex zone may not reflect reduced occupancy and thus habitat importance. Based on reception data from 2006-2012 at the York River bridge (Hager, unpublished) and Navy data since 2012 the York River system experiences little use by fish from other systems. To augment our ability to gather information on sturgeon within the York River system, tagging efforts were undertaken in the Pamunkey River, a tributary of the York, in August through early October of 2013 and in May and again in July-September in 2014. These efforts discovered a previously unknown reproducing population of native Atlantic sturgeon—capturing 96 Atlantic sturgeon in the Pamunkey River, with 23 recaptures. The 2013 study provided proof that a York River population existed and that it was spawning in the fall. Data from both 2013 and 2014 was also used to calculate spawning run population estimates for the river for two consecutive years. In addition these tagging efforts have provided tracking evidence that the system is used intensely by sturgeon of native origin. Why it is not used as frequently by transient sub-adults and adults as the James remains a question.

2. INTRODUCTION

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) was once abundant throughout the Chesapeake Bay and was an important food source for Native Americans and early colonists alike (Barbour 1986). Sturgeon were heavily fished for roe (i.e., caviar) and flesh at the end of the nineteenth century (Hildebrand and Schroeder 1928). Stocks collapsed coast-wide in the early 1900s under increased fishing pressure and congruent habitat alterations (Hildebrand and Schroeder 1928). A complete possession moratorium, which ended the commercial fishery for sturgeon, was imposed in Virginia in 1974 and the ban was extended to cover the whole Atlantic coast by the Atlantic States Marine Fisheries Commission (ASMFC) in 1998.

The Atlantic sturgeon is anadromous, which means spawning occurs in fresh water and adults spend most of their lives in marine and estuarine waters. For approximately the first year after hatching, Atlantic sturgeon remain within their freshwater nursery habitats and forage for benthic prey (Secor et al. 2000). As they age their range extends ever farther downriver (Van Den Avyle 1984). Some juveniles may reside within native fresh- and brackish-water nurseries for several years (Scott and Crossman 1973) while others exit into the marine environment in their second year. Both approaches have been recorded in Virginia waters. Congregations of fish between age 2 and 3 have been found in the mouth of the York River in the spring (Hager and Musick 2007), which suggests recent downriver emigration. Other juveniles of the same or lesser size have been recorded undertaking marine migrations, indicating that the age at which the species transitions to its coastal wandering habitats varies. Once it transitions, a fish will remain a coastal migrant that makes use of various coastal estuaries and rivers seasonally until maturity (Holland and Yelverton 1973). Fish reach maturity between the ages of 7 and 12, with males maturing earlier than females (Murdy et al. 1997). It was once presumed that spawning only occurred in the spring in Virginia waters based on research that had been done in the Hudson River (Murdy et al. 1997). Recent research has shown spawning also occurs in the fall in both the James (Balazik et al. 2012) and Pamunkey Rivers (Hager et al. 2014). Sub-adults close to maturity also occasionally join adults in upriver spawning runs (Hager 2012). Although a few sturgeon have been taken in deep offshore waters, most are captured near the coast (Vladykov and Greenley 1963). In Virginia, all scientifically documented catches have occurred in waters less than 20 meters (m) deep (Musick et al. 1993, Murdy et al. 1997).

Historically, data on the spatial and temporal details of Atlantic sturgeon occupancy and migration within Virginia have been extremely limited. The knowledge attained and shared among commercial sturgeon fishermen until the fisheries collapsed in the late 1900s was not documented. Later attempts at scientific descriptions of local behavior, residence, and migrations were of limited success due to the apparent scarcity of the species. Technological improvements in marine sonic-tracking equipment allow a small sonic tag to be inserted into a fish's body cavity. This technical advance, in conjunction with the collaboration of commercial fishermen for specimen collection, has greatly expanded our ability to research the species.

The first acoustic receiver array deployed in the Chesapeake Bay to track Atlantic sturgeon was placed in the middle (oligohaline) and upper (fresh water) portions of the James River by Chris Hager (Virginia Sea Grant, Virginia Institute of Marine Science) and Jack Musick (Virginia Institute of Marine Science) in 2006. Tracking between 2006 and 2012 revealed stark differences between river use by sub-adults and adults. Some sub-adults resided within the array year round. Adults made two runs into upriver reaches, one in the spring and one in the late summer (Hager and Musick 2007, Hager 2012). During both residence periods some adults occupied regions where physical parameters such as salinity, bottom type, dissolved oxygen, and temperature were suitable for spawning (Bushnoe et al. 2005).

The first run of adults starts in April and fish stage in the oligohaline reaches prior to immigration into fresh water reaches. By May, some adult have returned down river while others concentrate in the lower fresh water portions of the river. By June these will return down river. The second run into fresh water starts in late July. Most adults travel much farther upriver on this run and reside in the upper river within regions identified as suitable spawning grounds. Here they reside for an extended period of time from late summer through early fall. Fish were discovered running ripe in this section in 2007 (Hager and Musick 2007) and a large number of receptions within the region proved that congregations were annually reoccurring (Hager 2012). Through extensive sampling around receivers the collection of a female fish confirmed that fall spawning was occurring (Balazik et al. 2012). However, numerous factors suggests that sturgeon are not in this area just to spawn. First, during most of the late summer residence period water temperatures within these upriver regions are far too warm to spawn (Borodin 1925). Second, numerous adults occupy habitats at this time that contain no known spawning habitats. Third, these adults are often joined by sub-adults that do not spawn and finally perhaps most revealingly all preferred habitats occupied during the late summer are similar in physical attributes. Attributes recognized as motivating habitat selection by the species (Nitlitscheck 2001).

Tracking of juveniles (sub-adults) in the James River has revealed that this life stage has far less distinct patterns of habitat occupation and migration than adults (Hager 2012). Migration patterns are not as well-defined seasonally and habitat use appears to be more dispersed. Though occupation patterns are less defined, tracks and bycatch records suggests that sub-adults likely congregate in winter and summer refuge sites and demonstrate sedentary behavior during extreme temperature conditions (Hager 2012). Juveniles of varied sizes can be found in the James River throughout the year and they are known to use other within bay river systems prior to and during their coastal migrant life phase, as evidenced by the large number of James River juveniles found at the mouth of the York River in 2006 (Hager and Musick 2007).

Once juveniles exit their natal rivers, bycatch (Stein et al. 2004), scientific trawl (Laney et al. 2007) and tracking data (Eyler et al. 2004, Hager 2012) suggest that juveniles and adults use similar migration routes, occupy similar coastal habitats and even intermix temporally. Stein et al.'s (2004) examination of federal bycatch records indicates that sturgeon of varied size are most often caught within a narrow range of depths (30–160 ft [10–50 m]), over gravel and sand, and are strongly associated with specific coastal features, including the mouths of bays and inlets. These findings were supported by Laney et al. (2007) who used GIS layers to describe catches attained during Cooperative Winter Tagging Cruises. Subsequent scientific cruises (Wilson Laney, U.S. Fish and Wildlife Service, personal communication) and receiver data (Hager 2012) also identified potentially important wintering grounds in nearshore waters off the Outer Banks of North Carolina that are occupied congruently by individuals of varied life stages. Subsequent tracking in the spring, showed these fish making their way north along the coast, often entering coastal bays and rivers, with sub-adults spreading out in search of prey, and some adults returning to the James River to spawn (Hager 2102). Though it has long been recognized that an overall north-to-south and shallow-to-deep coastal migration pattern is evidenced seasonally by juveniles and adults alike (Holland and Yelverton 1973), advances in tracking and genetics are beginning to suggest that offshore migration and occupation patterns are not independent of genetic origin/DPS. Therefore, anthropogenic activities within ocean habitats may have DPS specific impacts dependent upon their spatial and temporal characteristics.

The Navy has a large presence in Virginia's lower Chesapeake Bay and nearshore Atlantic waters. In order to better understand potential naval impacts and gain additional biological data, receiver arrays were deployed within seven Chesapeake Bay regions: the Pamunkey River, York River, Chickahominy

River, James River, Elizabeth River, lower Chesapeake Bay, and Atlantic Ocean (**Figure 1**). Six zones of military interest occur within these regions, and receivers are strategically deployed within each: the Naval Weapons Station Yorktown/Cheatham Annex zone (York River region), Naval Station Norfolk zone (James River region), Elizabeth River zone, Little Creek zone, Fort Story zone (both in Chesapeake Bay region), and Dam Neck Firing Range Surrogate zone (Atlantic region).

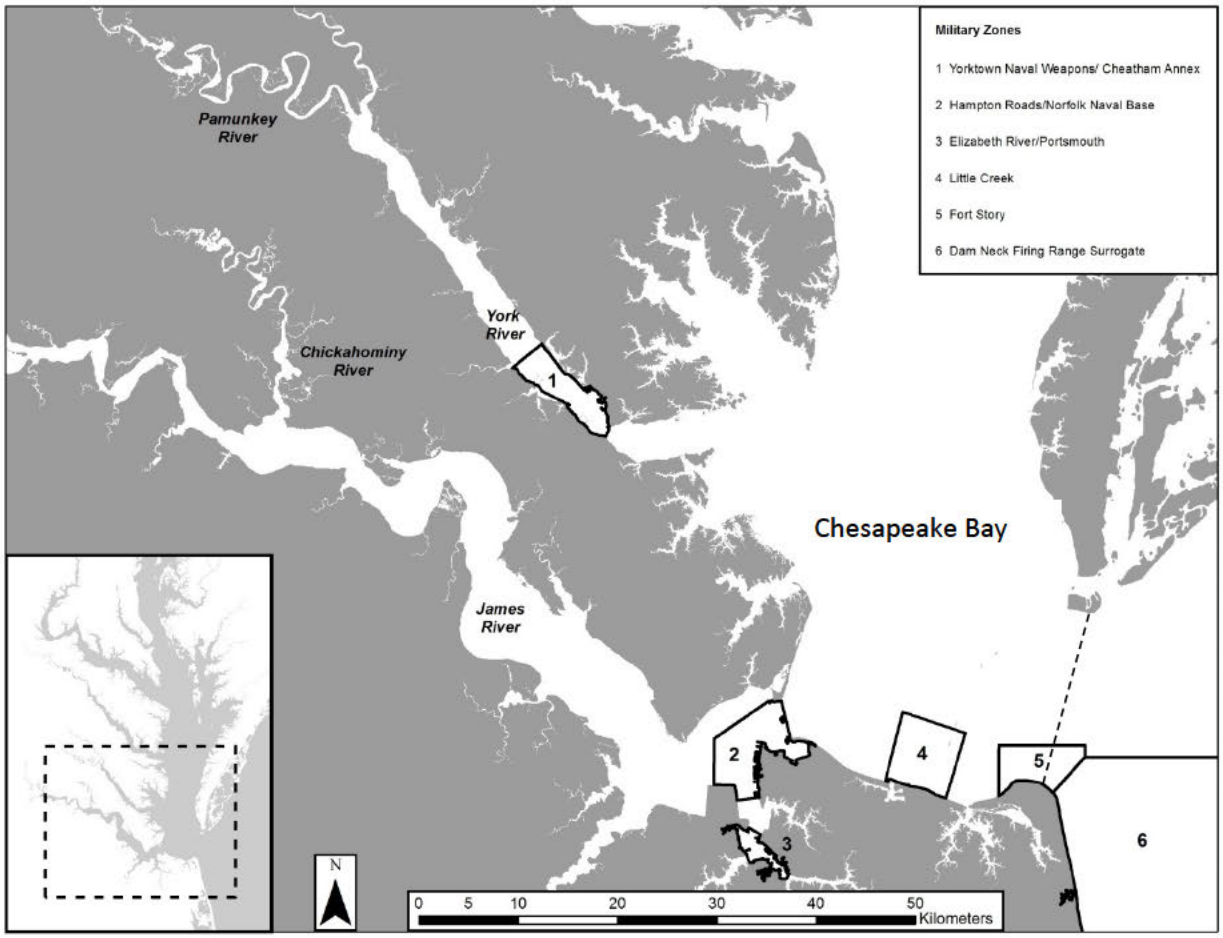

Figure 1. Geographical location illustrations of the regions in which the arrays were placed as well as the zones of military interest within these regions. Dashed line is the USCG COLREGS line.

There are numerous biological uncertainties surrounding Atlantic sturgeon within the Chesapeake Bay and its tributaries. To describe the potential importance of a specific military zone or activity, one must understand the life stages of the species present since habitat use characteristics vary with life stage. For instance, a river site may contain native young-of-the-year (YOY), as well as native and non-native juvenile and adult sturgeon. YOY are residents that depend solely upon their native river's habitats. Juveniles and adults in river habitats are transient though they may remain in a given river reach for months to benefit from biological and/or physical attributes. Juveniles and adults found in a bay or open-ocean site have begun to participate in migratory marine behaviors. Thus they are considered to be in their highly migratory/transient life stage. This does not imply that a given life stage may not be seasonally available for elongated periods of time in a given region or location, as is the case with adults on the spawning grounds, or sub-adults and adults congregating in overwintering sites.

Due to the location and size of the Naval Station Norfolk, the entire James River population has to pass through the Naval Station Norfolk zone at some life stage. Adults migrating to and from the spawning grounds may pass through once or twice a year. Juveniles may use the location for feeding and/or pass through during annual migrations. Seasonal use of the Elizabeth River by resident and migratory fish is also possible due to its location at the mouth of the James and the river may be used as a means of accessing the North Carolina sounds through the Intracoastal Waterway. When this study began, it was unclear whether the York River contained a reproducing population of sturgeon or not. Although YOY had been collected in the Pamunkey River (a tributary of the York River, located upstream of the Naval Weapons Station Yorktown/Cheatham Annex zone), suggesting that a remnant spawning population persisted (Musick et al. 1994), the National Marine Fisheries Service (NMFS) had thus far not obtained enough data to recognize this population. We now know that a stock of reproducing sturgeon remains in the York River (Hager et al. 2014). In addition, preliminary genetic analysis (King, USGS, personal communication) and an initial population assessment of the spawning run (Kahn et al. 2014) suggest that this genetically unique stock is very small. With what appears to be yet another DPS of Chesapeake origin than was previously recognized, the Yorktown Naval Weapons Station/Cheatham Annex zone is of much more importance to the species than previously recognized. These installations' piers extend out to the river's channel and their zones of influence cross it. Required maintenance of the pier related to pile driving and dredging may both affect this crucial habitat and migration corridor. To understand how important the York River zone is to sturgeon belonging to the endangered Chesapeake DPS and the newly discovered York River population, we first had to establish if reproduction is occurring in the York River system. With this established, tagging efforts can now be tailored to attain specimens, tag them and track them to define habitat use patterns for all appropriate life stages and migration times for returning adults.

The Fort Story and Little Creek zones, located strategically on the southern shore of the Chesapeake Bay's entrance along the southern channel, are likely used by the majority of sturgeon entering the Bay. The naval firing range in the Atlantic off Dam Neck along Virginia's southern coast is in an important migration corridor for sturgeon it is unclear if it serves as an overwintering ground. In addition to the range being situated just south of the entrance to the Chesapeake Bay, it is north and inshore of deeper waters located off North Carolina's Outer Banks, where fish belonging to numerous coastal stocks have been documented overwinter (Holland and Yelverton 1973, Hager 2012, Wilson Laney, U.S. Fish and Wildlife Service [USFWS], personal communication). Because of limited deployment options and an interest in reducing interference with range operations, a location that extends from the range's northern border and contains similar habitats, was selected as a surrogate sampling area.

The overarching objective of this contract was to begin delineating spatial and temporal patterns in Atlantic sturgeon occupancy in the lower Chesapeake Bay and nearshore waters, with a focus on zones of Navy interest. All zones contain some military activities that could impact sturgeon and/or their habitats. Results will be directly applicable to ESA Section 7, and support required analysis under NEPA and numerous other environmental policy decisions.

2.1 Assumption, Limitations, and Benefits of Using Tracking Data to Delineate Critical Habitats

In some cases fish follow instincts that are somehow programmed, as is the case with migration patterns/homing for spawning purposes and there is increasing evidence that this programming is genetically linked (Gerlach et al. 2006). Fish also seek out habitats with characteristics that optimize their bioenergetic budgets (Hager 2004, Niklitschek and Secor 2005). By quantifying and comparing occupancy patterns between sites of known habitat composition, one can delineate preference (as long

as the observed period of time is sufficient to characterize typical behavior and thus indicate biologically-based habitat selection). However, sufficient time is required to identify habitat preference through observations if the habitat is continually being altered by natural or anthropogenic activities. In order to minimize bias, the sub-set of fish to be used as specimens should be randomly collected with respect to the behavior of interests. For example, if all fish are displaying a given behavior or pattern of occupancy when collected, they do not represent an unbiased sample for quantifying the importance of this behavior or pattern.

Tracking data are observation-based and thus offer some advantages. Unlike predictive occupancy models, the factors motivating habitat selection do not have to be understood, weighted, or incorporated appropriately over time and space. By delineating habitat importance based on occupancy alone, and operating under the assumption that this indicates preference and thus suitability, prioritization of these regions as important to the species is justifiable without necessarily having to understand what motivates selectivity.

3. MATERIALS AND METHODS

3.1 TELEMETRY EQUIPMENT

This project's telemetry research used VEMCO® V16 and V13 sonic transmitters (VEMCO, Bedford, Nova Scotia, Canada) operating on a frequency of 69 kilohertz. Selected transmitters were engineered to be used in conjunction with a stationary array of VEMCO® VR2W receivers. They were not designed with short-duration transmission intervals or with varied frequencies, as a tag designed for active tracking (wherein the researcher follows the specimen) would be. The chosen tracking approach is referred to as passive because the receivers are stationary and the tagged fish are passively detected as they move within the receivers' reception distance.

VEMCO® transmitters (**Figure 2**) are named according to their diameters, thus a V16 tag is 16 millimeters (mm) and V13 is 13 mm. Tags can be engineered according to the researcher's needs, which are influenced by species morphology and tracking objectives. Longer tags have more batteries and thus the transmitter has a longer life span. Two tags with very different volumes and weights (V16, 90 mm long, 32 g in air; V13, 40 mm, 11 g) were selected for this study so that fish of different sizes could be tagged effectively. The V16s have an expected life of 2,331 days and the V13s are expected to last 779 days. The V13 transmitters also carry a pressure sensor that transmits an encoded depth output to the receivers. These data help identify where within a receiver's reception range a fish is located and helps describe behavior. Each tag transmits a unique identification number upon reception and the receiver records time and date. If the tag has a pressure sensor, an encoded depth code is included.

3.2 DETERMINING RECEPTION RANGE OF TRANSMITTERS

Experiments indicate that the reception range of marine sonic transmitters varies under different environmental conditions (Hager 2012, Robydek and Nunley 2012). Reception differences are also influenced by battery size and declining battery strength, which affect signal intensity. An average reception range was calculated for a VEMCO® V16 in the James River based on numerous field tests designed to examine the effect of marine noise and water depth. The Jamestown-Scotland Ferry pier was selected for shallow-water tests due to the presence of ferry noise and its extension across a range of bottom depths. Receptions were recorded under varied environmental conditions (e.g., different wave/energy conditions, water clarity) and at different times of the year. Both receiver and transmitter were moved between depths and data were recorded at a range of known distances. No effect from

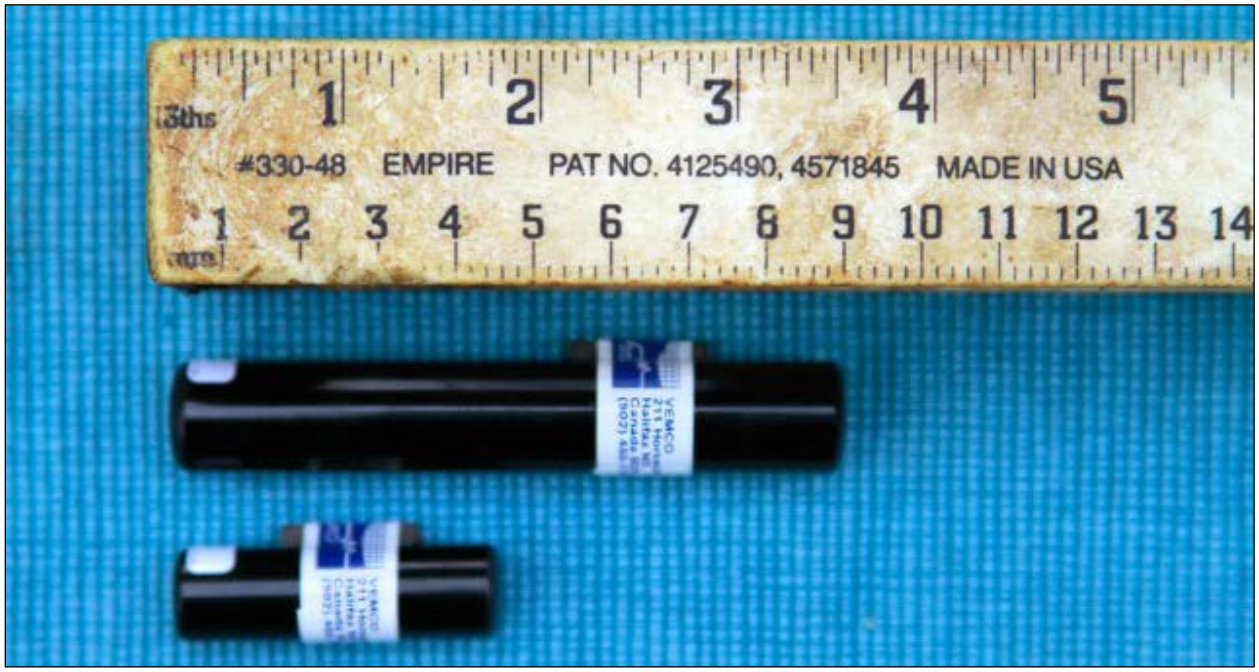

Figure 2. VEMCO V16 (top) and V13 (below) sonic transmitters.

ferry noise was evidenced, but the effect of environmental noise was severe during rough water conditions (breaking waves of 60 to 90 centimeters), when the receiver or transmitter was located in shallow water (< 2 meters [m]). Long-distance reception tests were conducted in Burwell's Bay, also in the James River. The maximum reception distance, under calm sea conditions, with transmitter and receiver both in deep water (10 m) was 1.3 kilometers [km]. Under rough conditions, with the transmitter or receiver placed in shallow water (i.e., 1 to 2 m deep), the reception distance was reduced to 0.2 km.

A distance of 0.7 km was selected as a mean reception distance. This measurement is a conservative average between the maximum and minimum distances recorded across a range of depths and conditions as observed in the middle James River. A slightly reduced average distance was selected due to the shallowness of the majority of riverine habitats and the frequently rough conditions that occur in these shallows. Due to the highly varied topography and bottom composition of the numerous receiver sites in this study, especially those in the nearshore Atlantic, reception distances and the effects of location need to be more rigorously assessed.

3.3 Sturgeon Collection and Tagging

Sturgeon of numerous age classes and life stages were tagged in highly varied geographical locations. Sturgeon tagged by our team (**Figure 3**) were done so under a federal scientific collection permit (National Oceanic and Atmospheric Administration [NOAA] permit 16547-01) and in accordance with recognized protocols stated clearly in the permit (see Mohler 2003 for description of surgical protocols). Other sturgeon collected and tagged by other researchers, also under Federal permits, were also detected by the Navy array. Prior tracking in the James River demonstrated that recently tagged fish often remained near their release site for a significant amount of time (Hager 2012). When this site is within an array's receptive area this behavior artificially enlarges the number of detections that would naturally occur at a given site. Since fish were not tagged in any location near zones of military interest, occupancy patterns within these zones are not due to any enduring effects of implantation.

Figure 3. Implantation of a V13 transmitter in an adult Atlantic sturgeon in the Pamunkey River.

All surgical, holding, and release methods applied by our team during this study were tested, proofed, and refined in preceding projects (Hager 2012). When fish were held in these previous studies, subsequent tracking recorded behavioral and habitat-selection alterations in order to proof surgical techniques. Alterations in behavior were at times so severe that adults abandoned migration runs. In this study therefore, sturgeon were never moved from the site of capture or held after surgery but were released immediately following an appropriate work-up, a procedure that often took less than 15 minutes. Permit protocols require that each sturgeon is T-bar and PIT (Passive Integrated Transponder) tagged with USFWS tags. Fish fork length must be measured (best measurement due to morphology of the species) and a caudal fin flesh sample is obtained for genetic analysis.

3.4 Telemetry Data Collection and Analysis

Receivers were placed on U.S. Coast Guard (USCG) buoys and day markers, bridge pilings, private docks, and lighthouses with permission granted through the USCG, the Office of Homeland Security, the Chesapeake Bay Bridge Tunnel Authority, and private landowners, respectively. Arrays were deployed to ensure coverage of all seven Chesapeake Bay regions and all six naval zones. The contract required that 70 receivers be deployed and checked monthly for maintenance and data collection. Data were downloaded via Bluetooth® wireless, or direct cable connection if a receiver was underwater. The goal of maintaining 70 receivers was consistently exceeded.

4. RESULTS

4.1 Tagging

In order to address a scarcity of tracking results in the York River drainage, we targeted Atlantic sturgeon for capture with anchored gillnets in the upper York and Pamunkey Rivers during 2012-2014. After obtaining several small fish in 2012 in the York River, we focused tagging efforts on the Pamunkey River

in the York River watershed initially to identify if spawning was occurring. Subsequently we worked to attain spawning population estimates and improve habitat-occupation data. Collection efforts were concentrated in the late summer and early fall; however, in 2014 we also conducted collection activities in the Pamunkey River for several months in the spring but obtained no fish.

During 2012-2013, we captured 18 sturgeon with 2 recaptures from the York River watershed using gillnets. Sixteen of these fish were tagged with transmitters, and these included 13 adult fish and 3 sub-adults (**Table 1**). In 2014, 78 sturgeon were collected, with 21 recaptures, and 31 more transmitters were implanted.

Table 1. Information on each fish tagged through this contract. (* = recaptures; fork lengths in bold are sub-adults)

Date Tagged/ Recaptured	PIT Tag #	T Tag #	Fork Length (mm)	Transmitter #	River	Sex
11/28/2012	None	none	**525**	A69-9002-13585	York	Unknown
12/2/2012	985121012611425	46350	**570**	A69-9002-13586	York	Unknown
8/19/2013	985121012745260	46345	1,340	A69-9001-27837	Pamunkey	Unknown
8/19/2013	985121012611330	46346	**1,250**	A69-9001-27842	Pamunkey	Unknown
8/20/2013	985121011606351	46349	1,290	A69-9001-27840	Pamunkey	Unknown
8/20/2013	985121012760407	46348	1,550	A69-9001-27847	Pamunkey	M
8/22/2013	47025C7C03	none	1,330	A69-9001-27838	Pamunkey	M
8/22/2013	985121012638136	none	1,627	A69-9001-27836	Pamunkey	M
8/22/2013	985121012617104	none	1,345	A69-9001-27844	Pamunkey	Unknown
8/23/2013	900118001183738	48101	1,918	A69-9001-27845	Pamunkey	F
8/29/2013	900118001182852	48115	1,570	A69-9001-27839	Pamunkey	M
8/29/2013*	47025C7C03	none	1,330	A69-9001-27838	Pamunkey	M
9/6/2013	900118001183196	48095	1,543	none	Pamunkey	M
9/10/2013	900118001181459	48100	1,651	A69-9001-27846	Pamunkey	Unknown
9/13/2013	900118001201865	48114	1,524	A69-9001-27843	Pamunkey	M
9/13/2013	900118001202200	48113	1,562	A69-9002-13589	Pamunkey	M
9/25/2013	985161000824836	48112	1,510	A69-9002-13587	Pamunkey	M
10/3/2013	None	48051	1,664	none	Pamunkey	M
10/4/2013*	900118001202200	48113	1,562	A69-9002-13589	Pamunkey	M
10/8/2013	900118001183823	48052	1,572	none	Pamunkey	Unknown
8/5/2014	900118001339357	48070	1600	none	Pamunkey	Unknown
8/6/2014	900118001202201	50751	1613	A69-9002-12730	Pamunkey	Unknown
8/6/2014	NA - malfunction	48104	1295	A69-9002-12732	Pamunkey	Unknown
8/6/2014	900118001181160	50752	1607	A69-9001-27841	Pamunkey	Unknown
8/7/2014	900118001184159	50801	1575	A69-9002-12737	Pamunkey	M
8/7/2014	900118001201930	50753	1702	A69-9002-12735	Pamunkey	M
8/11/2014	900118001181162	48069	1657	A69-1601-7698	Pamunkey	M
8/11/2014	900118001183583	48058	1956	A69-1601-3779	Pamunkey	Unknown
8/11/2014	900118001342256	48068	1537	A69-9002-12742	Pamunkey	M
8/13/2014	900118001183957	48054	1486	A69-9002-12746	Pamunkey	Unknown
8/13/2014*	985121012760407	46348	1610	A69-9001-27847	Pamunkey	M
8/19/2014	900118001183713	48067	1661	none	Pamunkey	M
8/19/2014	900118001182295	48061	2057	A69-9002-12731	Pamunkey	F
8/19/2014	900118001182724	48066	1461	none	Pamunkey	Unknown
8/19/2014	?	48065	1594	none	Pamunkey	M
8/19/2014	900118001183395	48057	2146	none	Pamunkey	F
8/21/2014	900118001339357	48056	1854	A69-9002-12749	Pamunkey	Unknown
8/27/2014*	900118001183196	48055	1543	A69-9002-12748	Pamunkey	M
8/27/2014	989001003179718	50338	1575	A69-9001-24476	Pamunkey	M

Date Tagged/ Recaptured	PIT Tag #	T Tag #	Fork Length (mm)	Transmitter #	River	Sex
9/5/2014	989001003179804	50340 and 50754	1534	A69-9001-24479	Pamunkey	M
9/5/2014	900118001359318	48062	1715	A69-9002-12740	Pamunkey	M
9/5/2014	900118001182597	48063	1607	A69-9002-12738	Pamunkey	M
9/5/2014*	985121012760407	46348	1610	A69-9001-27847	Pamunkey	M
9/5/2014	900118001184141	48064	1724	A69-9002-12733	Pamunkey	Unknown
9/8/2014	989001003179730	50802	1683	A69-9002-26380	Pamunkey	Unknown
9/8/2014	900118001201948	50803	1934	A69-9002-12750	Pamunkey	Unknown
9/8/2014	985121026865700	50804	1810	A69-9002-12736	Pamunkey	Unknown
9/8/2014	900118001202071	50805	1581	A69-9002-12754	Pamunkey	Unknown
9/8/2014	900118001182788	50806	1803	A69-9002-12752	Pamunkey	Unknown
9/8/2014*	900118001181459	50807	1689	A69-9001-27846	Pamunkey	M
9/9/2014*	900118001182788	50806	1803	A69-9001-12752	Pamunkey	Unknown
9/9/2014*	900118001183713	48067	1661	A69-9002-12745	Pamunkey	M
9/9/2014	900118001182977	50808	1746	A69-9002-12747	Pamunkey	M
9/9/2014	900118001340773	50809	1981	none	Pamunkey	Unknown
9/10/2014	900118001183504	50755	1511	A69-9002-12739	Pamunkey	M
9/10/2014	900118001183842	50810	1524	A69-9002-12741	Pamunkey	M
9/10/2014	900118001202000	50811	1394	A69-9002-12734	Pamunkey	M
9/12/2014	900118001182734	50757	1880	A69-1601-3780	Pamunkey	F
9/12/2014	900118001184316	50756	1702	A69-9002-12751	Pamunkey	M
9/15/2014	900118001183592	50758	2045	A69-9002-12753	Pamunkey	Unknown
9/15/2014	900118001183545	50759	1588	A69-9002-12755	Pamunkey	M
9/15/2014*	900118001184159	50801	1575	A69-9002-12737	Pamunkey	M
9/17/2014	900118001184145	50812	1695	A69-9002-12743	Pamunkey	M
9/17/2014	900118001342234	50813	1854	A69-9002-12758	Pamunkey	Unknown
9/17/2014*	900118001342256	50814	1537	A69-9002-12742	Pamunkey	M
9/17/2014	900118001183266	50815	1664	A69-9002-12744	Pamunkey	Unknown
9/17/2014*	900118001183583	48058	1956	A69-1601-3779	Pamunkey	Unknown
9/17/2014	989001003179768	50337	2083?	A69-9002-12707	Pamunkey	Unknown
9/18/2014*	900118001340773	50809	1981	none	Pamunkey	Unknown
9/18/2014	900118001183356	50816	1829	none	Pamunkey	F
9/18/2014	900118001183382	50817	1543	none	Pamunkey	M
9/18/2014	FDXA42137D5A54	50818	1664	none	Pamunkey	M
9/19/2014	900118001182180	50819	1695	none	Pamunkey	M
9/19/2014	900118001183693	50820	2064	none	Pamunkey	Unknown
9/22/2014	900118001183749	50821	1649	none	Pamunkey	M
9/22/2014	900118001182680	50822	1707	none	Pamunkey	M
9/22/2014	989001003179728	50342	1600	A69-9001-26381	Pamunkey	M
9/22/2014	989001003179745	50336	1800	A69-9001-26380	Pamunkey	M
9/22/2014	900118001182326	50823	1641	none	Pamunkey	M
9/22/2014*	900118001182852	48115	1581	A69-9001-27839	Pamunkey	M
9/22/2014*	900118001202200	48113	?	A69-9002-13589	Pamunkey	M
9/22/2014*	900118001183504	50755	1511	A69-9002-12739	Pamunkey	M
9/22/2014*	900118001183545	50759	1588	A69-9002-12755	Pamunkey	M
9/22/2014*	900118001181551	48114	1534	A69-9001-27843	Pamunkey	M
9/22/2014	900118001184283	50824	1387	none	Pamunkey	M
9/22/2014	900118001181514	50825	1665	none	Pamunkey	M
9/22/2014	out of PIT tags	50826 and 50827	1467	none	Pamunkey	M
9/22/2014*	900118001184159	50801	1575	A69-9002-12737	Pamunkey	M
9/23/2014*	900118001183749	50821	1649	A69-9002-12756	Pamunkey	M
9/23/2014	989001000099119	50828	1575	none	Pamunkey	Unknown
9/23/2014*	900118001201930	50753	1702	A69-9002-12735	Pamunkey	M

Date Tagged/ Recaptured	PIT Tag #	T Tag #	Fork Length (mm)	Transmitter #	River	Sex
9/23/2014*	900118001342256	50814	1537	A69-9002-12742	Pamunkey	M
9/23/2014*	900118001202071	50805	1581	A69-9002-12754	Pamunkey	M
9/24/2014	989001003179715	50829	1670	none	Pamunkey	M
9/24/2014	989001000099115	50830	~1715	A69-9002-12757	Pamunkey	M
9/24/2014	989001000099066	50831	1410	none	Pamunkey	M
9/24/2014	989001000099108	50832	1505	none	Pamunkey	M
9/25/2014*	900118001183356	50816	1829	A69-9002-13588	Pamunkey	F

Key: F = Female; M = Male.

VEMCO® V13 or V16 transmitters were used. Fish were selected for receiving a V13 depending on the fish's body weight and/or the researcher's desire to obtain depth data. Consequently, some adults were implanted with V13 tags although their body size would have accommodated a V16. Two females bearing eggs were equipped with external V13s to minimize the impact of tagging. These were attached along the midline of the dorsal fin using 400-pound monofilament that was surgically inserted under the dorsal fin, run through the transmitter's external eye and run back under the dorsal and double crimped with brass on the opposite side.

Sex was determined by external expression of gametes. There are no external methods of determining the sex for an Atlantic sturgeon. Five of the adults were confirmed to be females, and 41 males collected were emitting milt (i.e., seminal fluid) upon capture; the rest were unknown. The presence of so many adult fish during suitable water temperatures (18–20 degrees Celsius) suggested that spawning could be occurring. Spawning activity was confirmed on 23 August 2013, when a nearly spent female still expelling residual eggs was collected (Hager et al. 2014). Eggs were collected and preserved for analysis. The fact that captured adults were spawning proves that they are native York River fish and not simply transient adults seeking fresh water refuge during the heat of summer. The size/age of the sub-adults collected in December suggests these fish were also natives leaving the river for the first time. Genetic analysis of these samples is ongoing and will result in another paper published in a peer-reviewed journal in the future. Results thus far suggest the York River contains a unique stock of fish unrelated to those found in the James River which may in part explain why so few non-native fish have been recorded entering the York River system.

4.2 Array Coverage

Due to loss and breakage, every receiver site did not contain an operational receiver during every day of every month of the study. Gaps in receiver operation may have resulted in missed detections. The likelihood of missed detections is positively correlated with the amount of time a receiver was not functional and receiver malfunction and loss were positively correlated with the amount of wave energy to which the receiver was exposed. Within the first year we stopped monitoring at several sites that experienced high loss rates and/or were in very close proximity to other receivers. These sites were 11n (Chesapeake Region), NH3 (Naval Station Norfolk), B3 (Fort Story), NCA (Atlantic Region) and CB15 (Range Surrogate)and these sites were not monitored in 2014. The largest gaps in receiver coverage due to receiver failure or loss occurred in the Atlantic Ocean in the Range Surrogate zone followed by the Chesapeake Bay region and then Fort Story at the mouth of the Chesapeake Bay. Losses in other military zones were minimal or non-existent. The importance of data gaps within military zones of interest may be underestimation of sturgeon occupation due to reduced receiver function. **Table 2** lists receiver site, region and military zone, if applicable, and describes monitoring by month. It does not include every time a receiver site was maintained due to limited space.

Table 2. Summary of monitoring for sonic-tagged sturgeon, January 2014–December 2014

Note: Block colors indicate the site's status during a given period: white denotes the site was not monitored, green denotes the receiver was fully functional, yellow indicates that data may be missing and red denotes that a broken receiver was at the location during some of the monitoring period. The number in the month columns is the date of maintenance. An R following this date denotes that the receiver was retrieved, D denotes deployment, B denotes broken unknown cause, W that the receiver was wet internally, C indicates clock failure and USCG means that the buoy was replaced by the USCG and the receiver removed. The 10/1 in the September column indicates the receiver was read on October 1. Abbreviations are as follows. For regions: Pam. is Pamunkey, Chick. is Chickahominy, Eliz. is Elizabeth, and Ches. is Chesapeake and for military zones; NW/Ch. is Naval Weapons/Cheatham Annex, NSN is Naval Station Norfolk and Range Sur. is the surrogate for the Naval Firing Range Surrogate off of Dam Neck

Receiver Site	Region	Military zone	1st trip 2013	2nd trip 2013	3rd trip 2013	4th trip 2013	5th trip 2013	6th trip 2013	7th trip 2013	8th trip 2013	9th trip 2013	10th trip 2013	11th trip 2013	12th trip 2013	13th trip 2013
CB	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/8/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/2/2013	11/22/2013LD	12/13/2013
CB1	Atlantic	Range Sur.	12/4/2012	1/8/2013LD	2/15/2013	3/15/2013	4/8/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/2/2013	11/22/2013	12/13/2013
CB11	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/21/2013	11/22/2013	12/13/2013
CB13	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/30/2013	5/14/2013	6/12/2013	7/29/2013RD	8/13/2013	9/20/2013LD10/12	10/21/2013RCD	11/22/2013	12/13/2013RCD
CB15	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013L	not deployed								
CB3	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/8/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/2/2013	11/22/2013	12/13/2013
CB5	Atlantic	Range Sur.		1/4/2013	2/15/2013	3/15/2013L	3/15/2013D	4/8/2013	5/14/2013	7/29/2013	8/13/2013	9/20/2013	10/2/2013	11/22/2013	12/13/2013
CB7	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013L	3/15/2013	4/8/2013D	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/21/2013	11/22/2013	12/13/2013
CB9	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/14/2013	6/12/2013	7/29/2013	7/29/2013	9/20/2013	10/21/2013RC	11/22/2013D	12/13/2013
RA	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013RD	4/8/2013	5/14/2013	6/12/2013	7/23/2013L	8/27/2013	9/19/2013D	10/21/2013	11/22/2013RCD	12/15/2013
RA outside	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013RD	4/8/2013	5/14/2013	6/12/2013	7/23/2013	8/27/2013	9/19/2013	10/21/2013	11/22/2013	12/13/2013
RI1	Atlantic	Range Sur.	1/4/2013	1/8/2013	2/15/2013	3/15/2013R	3/15/2013D	4/8/2013	5/14/2013	6/12/2013	7/23/2013	8/27/2013L	9/19/2013D	10/21/13RWD	12/15/2013RWD
RI2	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013L	3/15/2013D	4/8/2013	5/14/2013	6/12/2013	7/23/2013L		9/19/2013D	10/21/2013RWD	11/22/2013	12/15/2013RCD
CH	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/17/2013		4/17/2013	5/15/2013	6/25/2013	7/29/2013L			10/22/2013D	11/22/2013RW	
CH1	Atlantic	Range Sur.	12/4/2012	1/4/2013	2/15/2013	3/15/2013	4/17/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013L	10/2/2013D	11/22/2013	12/13/2013
NCA	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/15/2013	6/25/2013	7/30/2013	Not deployed				
NCB	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/8/2013	5/15/2013	6/25/2013	7/30/2013	8/13/2013	9/5/2013	10/2/2013	11/22/2013LD	12/17/2013
NCC	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/15/2013	6/25/2013	7/30/2013	8/13/2013	9/5/2013	10/2/2013	11/22/2013LD	12/17/2013
NCD	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/8/2013	5/15/2013	6/25/2013	7/30/2013	8/13/2013	9/5/2013	9/20/2013RB	10/2/2013D	11/22/2013
NCE	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/15/2013	6/25/2013	7/30/2013	8/13/2013	9/5/2013	10/2/2013	11/22/2013LD	12/17/2013
2CH	Ches. Bay	Fort Story	12/4/2012	1/8/2013	2/19/2013	3/15/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013	8/27/2013	9/20/2013	10/22/2013	11/22/2013	12/17/2013
TS1	Ches. Bay	Fort Story	12/4/2012	1/8/2013	2/19/2013	3/15/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013	8/27/2013	9/20/2013	10/22/2013	11/25/2013	12/17/2013
TS3	Ches. Bay	Fort Story	12/4/2012	1/8/2013	2/19/2013	3/15/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013	8/30/2013	9/20/2013	10/22/2013	11/25/2013	12/17/2013
B3	Ches. Bay	Fort Story	12/4/2012	1/8/2013	2/17/2013	3/29/2013L	not deployed								
2C HENRY	Atlantic	Fort Story	12/4/2012	1/8/2013		3/29/2013LD	4/17/2013	5/15/2013	6/18/2013	6/24/2013	7/29/2013	8/27/2013	9/20/2013	10/22/13USCGD	11/22/2013RW
CBBT4	Ches. Bay	Little Creek		1/9/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013	8/30/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
CBBT5	Ches. Bay	Little Creek		1/9/2013	2/19/2013	3/28/2013	4/30/2013	5/15/2013	6/24/2013	7/30/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
LC1	Ches. Bay	Little Creek	12/4/2012	1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
LC2	Ches. Bay	Little Creek		1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
TS11	Ches. Bay	Little Creek	12/4/2012	1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
TS7	Ches. Bay	Little Creek	12/4/2012	1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013	11/25/2013	12/17/2013	1/14/2014
TS9	Ches. Bay	Little Creek	12/4/2012	1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013L	10/22/2013D	11/25/2013	12/17/2013
10N	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013	4/30/2013	5/15/2013	6/24/2013	7/29/2013	8/30/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
11N	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013/R	not deployed								
CBBT1	Ches. Bay			1/9/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013	8/30/2013	10/1/2013	10/22/2013	11/25/2013RBD	12/17/2013	1/14/2014
LS	Ches. Bay			1/8/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013L	7/29/2013D	8/2/2013R	9/20/2013D	10/1/2013	11/25/2013	12/17/2013
CBBT2	Ches. Bay			1/9/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013R			10/1/2013D	11/25/2013	12/17/2013
CBBT3	Ches. Bay			1/9/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/24/2013L	7/29/2013D	8/30/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
CBBT7	Ches. Bay		not deployed	not deployed	not deployed	3/29/2013	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/30/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013

Receiver Site	Region	Military zone	1st trip 2013	2nd trip 2013	3rd trip 2013	4th trip 2013	5th trip 2013	6th trip 2013	7th trip 2013	8th trip 2013	9th trip 2013	10th trip 2013	11th trip 2013	12th trip 2013	13th trip 2013
TS5	Ches. Bay		12/4/2012	1/8/2013	2/19/2013	3/15/2013	4/17/2013	5/15/2013	6/25/2013	7/30/2013	8/27/2013	9/20/2013	10/22/2013LD	11/25/2013	12/17/2013
B11	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013L	4/17/2013D	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
B13	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013LD	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
B15	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013RD
B5	Ches. Bay		12/4/2012	1/8/2013	2/17/2013	3/29/2013LD	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/22/2013	12/17/2013
B7	Ches. Bay		12/4/2012	1/8/2013	2/15/2013L		4/17/2013D	5/15/2013	6/24/2013	7/29/2013	8/30/2013	10/1/2013	10/22/2013	11/22/2013	12/17/2013
B9	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/22/2013	12/17/2013
NH5	James River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	not deployed			
NN 1ER FWS	James River	NSN	not deployed	not deployed	not deployed	not deployed	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN 3ER NOAA SP	James River	NSN	not deployed	not deployed	not deployed	not deployed	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN DANGER FWS	James River	NSN	not deployed	not deployed	not deployed	not deployed	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN R22 NOAA SP	James River	NSN	not deployed	not deployed	not deployed	not deployed	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN2	James River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN5	James River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013RD	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013L	10/17/2013D	11/6/2013	12/6/2013
NN8	James River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH8	Eliz. River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH10	Eliz. River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH12	Eliz. River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH14	Eliz. River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
APMI	Eliz. River	Eliz. River	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH29	Eliz. River	Eliz. River	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH32	Eliz. River	Eliz. River	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH36	Eliz. River	Eliz. River	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
Y PAGE	York River	NW/Ch.	12/6/2012	1/7/2013	2/11/2013	3/5/2013	4/23/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/18/2013	12/4/2013
Y WAT	York River	NW/Ch.	12/7/2012	1/4/2013	1/31/2013	3/13/2013	4/18/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/30/2013	11/18/2013	12/4/2013
Y2	York River	NW/Ch.	12/6/2012	1/7/2013	2/11/2013	3/5/2013	4/23/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/18/2013	12/4/2013
Y8	York River	NW/Ch.	12/6/2012	1/7/2013	2/11/2013	3/5/2013	4/23/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/30/2013	11/18/2013RD	12/4/2013
Y BELL NOAA	York River			1/7/2013	2/11/2013	3/13/2013	4/23/2013	5/8/2013	6/19/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
Y12	York River		12/6/2012	1/7/2013	2/11/2013	3/5/2013	4/23/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
Y18 NOAA	York River		12/1/2012	1/7/2013	2/11/2013	3/13/2013	4/23/2013	5/8/2013	6/19/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
Y20 NOAA	York River				2/11/2013	3/13/2013	4/23/2013	5/8/2013	6/19/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
Y29 NOAA	York River				2/11/2013	3/13/2013	4/23/2013	5/8/2013	6/19/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
PAM 360	Pam. River											9/10/2013	10/4/2013	11/5/2013	12/10/2013
PAM (b) (6) UPPER	Pam. River										8/20/2013	9/10/2013	10/4/2013	11/5/2013	12/10/2013
PAM (b) (6)	Pam. River		1/2/2013	2/4/2013	3/7/2013	4/1/2013	5/7/2013	6/6/2013	7/8/2013	8/1/2013	8/29/2013	9/10/2013	10/4/2013	11/5/2013	12/13/2013
PAM BRICK WALL	Pam. River											9/13/2013	10/4/2013	11/5/2013	12/10/2013
PAM Res.	Pam. River		1/2/2013	2/4/2013	3/7/2013	4/28/2013	5/7/2013	5/31/2013	6/6/2013	7/8/2013	8/1/2013	9/10/2013	10/4/2013	11/5/2013	12/10/2013
PAM (b) (6)	Pam. River		1/2/2013	2/4/2013	3/7/2013	4/1/2013	5/7/2013	6/6/2013	7/8/2013	8/1/2013	9/10/2013	10/4/2013	11/5/2013	12/10/2013	1/3/2014
PAM (b) (6)	Pam. River		1/2/2013	3/6/2013	3/6/2013	4/1/2013	5/7/2013	6/6/2013	7/8/2013	8/1/2013	9/9/2013	10/4/2013	11/5/2013	12/10/2013	1/3/2014

Receiver Site	Region	Military zone	1st trip 2014	2nd trip 2014	3rd trip 2014	4th trip 2014	5th trip 2014	6th trip 2014	7th trip 2014	8th trip 2014	9th trip 2014	10th trip 2014	11th trip 2014	12th trip 2014	1st trip 2015
CB	Atlantic	Range Sur.	1/31/2014RWD	2/20/14RWD	3/12/2014RWD	4/25/2014RWD	5/7/2014	6/18/2014	7/30/2014	9/2/2014LD	10/2/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB1	Atlantic	Range Sur.	1/31/2014RCD	2/20/14 RCD	3/12/2014RCD	4/25/2014RCD	5/7/2014	6/18/2014	7/30/2014	9/2/2014LD	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB11	Atlantic	Range Sur.	1/31/2014	2/20/2014	3/12/2014	buoy gone	buoy gone	6/18/2014D	7/31/2014L	9/2/2014D	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB13	Atlantic	Range Sur.	1/31/2013C	2/20/14RCD	3/12/2014	4/25/2014	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB15	Atlantic	Range Sur.	not deployed												
CB3	Atlantic	Range Sur.	1/31/2014RD	2/20/14RCD	3/12/2014	4/25/2014	5/7/2014	6/18/2014	7/30/2014 USCGRD	9/2/2014	10/9/2014LD	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB5	Atlantic	Range Sur.	1/31/2014RCD	2/20/2014	3/12/2014RWD	4/25/2014RWD	5/7/2014	6/18/2014	7/30/2014	9/2/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB7	Atlantic	Range Sur.	1/31/2014RCD	2/20/2014RCD	3/12/14RCD	4/25/2014RCD	5/7/2014	6/18/2014	7/30/2014	9/2/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB9	Atlantic	Range Sur.	1/31/2014RCD	2/20/2014	3/12/2014	4/25/2014	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
RA	Atlantic	Range Sur.	1/26/2014	2/20/2014	not retrievable	4/25/2014	5/7/2014	6/18/2014	7/30/2014 USCGRD	9/2/2014	10/9/2014	10/20/2014	11/10/2014	12/28/2014	1/11/2015
RA outside	Atlantic	Range Sur.	1/26/2014RWD	2/20/2014	not retrievable	4/25/2014	5/7/2014	6/18/2014	7/30/2014	9/2/2014	10/9/2014	10/20/2014	11/10/2014	12/28/2014	1/11/2015
RI1	Atlantic	Range Sur.	1/26/2014	2/20/2014	not retrievable	4/25/2014	5/7/2014	6/18/2014	7/30/2014 USCGRD	9/2/2014	10/9/2014	10/20/2014	11/10/2014	12/18/2014	1/11/2015
RI2	Atlantic	Range Sur.	1/26/2014RCD	2/20/2014	not retrievable	4/25/2014	5/7/2014	6/18/2014LD	7/30/2014	9/2/2014	10/9/2014	10/20/2014	11/10/2014	12/28/2014LD	1/11/2015
CH	Atlantic	Range Sur.		2/27/2014	3/12/2014	4/2/2014	5/7/2014	6/18/2014	7/31/2014	9/3/2014	10/9/2014	10/9/2014	11/10/2014	12/15/2014	1/11/2015
CH1	Atlantic	Range Sur.	1/14/2014	2/27/2014	3/12/2014	4/2/2014	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/9/2014	11/10/2014	12/20/2014	1/11/2015	
NCA	Atlantic		not deployed												
NCB	Atlantic		1/31/2014RCD	2/20/2014RCD	3/12/2014	4/25/2014	5/21/2014	6/19/2014	7/31/2014	9/3/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
NCC	Atlantic		1/31/2014RCD	2/20/2014	3/12/2014	4/25/2014	5/21/2014	6/19/2014	7/31/2014	9/3/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
NCD	Atlantic		1/31/2014	2/20/2014	3/12/2014	4/25/2014	5/21/2014	6/19/2014	7/31/2014	9/3/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
NCE	Atlantic		1/31/2014RWD	2/20/2014	3/12/2014	4/25/2014	5/21/2014	6/19/2014RBD	7/31/2014	9/3/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
2CH	Ches. Bay	Fort Story	1/14/2014	2/27/2014	3/12/2014	4/2/2014	5/21/2014	6/19/2014			10/10/2014	10/21/2014	11/25/2014	12/15/2014	1/11/2015
TS1	Ches. Bay	Fort Story	1/14/2014	2/27/2014	3/12/2014	4/2/2014	5/21/2014	6/18/2014	7/31/2014	9/3/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
TS3	Ches. Bay	Fort Story	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/7/2014	6/18/2014	7/31/2014	9/3/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B3	Ches. Bay	Fort Story	not deployed												
2C HENRY	Atlantic	Fort Story		2/27/2014D	3/12/2014	4/2/2014	5/7/2014	6/18/2014	7/31/2014	9/3/2014	10/3/2014	10/9/2014	11/10/2014	12/20/2014	1/11/2015
CBBT4	Ches. Bay	Little Creek	1/26/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/21/2014	11/25/2014	12/28/2014	1/20/2015
CBBT5	Ches. Bay	Little Creek	1/26/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/21/2014LD	11/25/2014	12/28/2014	1/20/2015
LC1	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
LC2	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
TS11	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
TS7	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
TS9	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
10N	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/3/2014	10/3/2014	not reachable	11/25/2014	12/15/2014	1/20/2015
11N	Ches. Bay		not deployed												
CBBT1	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014		10/3/2014	11/25/2014	12/28/2014	1/20/2015
LS	Ches. Bay		1/14/2014	1/14/2014	2/27/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	not reachable	10/3/2014	11/25/2014	12/28/2014	1/20/2015
CBBT2	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014		10/3/2014	11/25/2014	12/28/2014	1/20/2015
CBBT3	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014		10/3/2014	11/25/2014	12/28/2014	1/20/2015
CBBT7	Ches. Bay		1/14/2014	2/27/2014	4/2/2014LD	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014		10/3/2014	11/25/2014	12/28/2014	1/20/2015LD
TS5	Ches. Bay		1/26/2014	2/27/2014	4/2/2014	4/24/2014	4/24/2014	5/7/2014	6/18/2014	7/23/2014	9/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B11	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/7/2014	6/18/2014	7/23/2014 USCGRD	9/2/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B13	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014 USCGRD	9/2/2014	10/3/2014	not reachable	11/25/2014	12/15/2014	1/20/2015
B15	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	10/3/2014	not reachable	11/25/2014	12/15/2014	1/20/2015
B5	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/18/2014	7/31/2014USCGRD	9/3/2014	10/3/2014USCGRD	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B7	Ches. Bay		1/14/2014	2/27/2014RCD	buoy gone in March	4/2/2014D	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B9	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015

Receiver Site	Region	Military zone	1st trip 2014	2nd trip 2014	3rd trip 2014	4th trip 2014	5th trip 2014	6th trip 2014	7th trip 2014	8th trip 2014	9th trip 2014	10th trip 2014	11th trip 2014	12th trip 2014	1st trip 2015
NH5	James River	NNB	not deployed												
NN 1ER FWS	James River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN 3ER NOAA SP	James River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN DANGER FWS	James River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN R22 NOAA SP	James River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN2	James River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN5	James River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN8	James River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH8	Eliz. River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH10	Eliz. River	NNB	1/9/2014	2/6/2014	3/21/2014LD	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH12	Eliz. River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH14	Eliz. River	NNB	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
APMI	Eliz. River	Eliz. River	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH29	Eliz. River	Eliz. River	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH32	Eliz. River	Eliz. River	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH36	Eliz. River	Eliz. River	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
Y PAGE	York River	NW/Ch.	1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y WAT	York River	NW/Ch.	1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y2	York River	NW/Ch.	1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y8	York River	NW/Ch.	1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y BELL NOAA	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y12	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y18 NOAA	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y20 NOAA	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y29 NOAA	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Pam. 360	Pam. River		1/3/2014	2/4/2014	3/20/2014	4/10/2014	5/1/2014	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/3/2014	12/1/2014	1/6/2015
Pam. top $	Pam. River		seasonal							8/11/2014D	9/11/2014	10/6/2014	11/4/2014		
Pam. TOP 1	Pam. River		seasonal						7/26/2014D	8/12/2014	9/11/2014CRD	10/6/2014	11/4/2014		
Pam. rootball	Pam. River		seasonal							8/11/2014D	9/11/2014	10/6/2014	11/4/2014		
Pam. hickory	Pam. River		seasonal						7/21/2014D	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam. farm H2O	Pam. River		seasonal						7/21/201D	8/14/2014	9/11/2014	10/6/2014	11/4/2014		
Pam. (b) (6) upper	Pam. River		seasonal				5/1/2014D	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/4/2014		
Pam. Lower up(b) (6)	Pam. River		seasonal						7/26/2014D	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam Fossil Cliff	Pam. River		seasonal						7/26/2014D	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam.(b) (6)	Pam. River		not reachable	2/4/2014	3/20/2014	4/10/2014	5/1/2014	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/3/2014	12/1/2014	1/6/2015
Pam(b) (6) lower	Pam. River		seasonal						7/26/2014D	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam.(b) (6) (b) (6)	Pam. River		seasonal								9/5/2014D	10/6/2014	11/4/2014		
Pam. poles	Pam. River		seasonal								9/15/2014D	10/6/2014	11/3/141		
Pam. Brick wall	Pam. River		seasonal				5/1/2014D	6/2/2014	7/26/2014	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam. Res.	Pam. River		1/3/2014	2/4/2014	3/20/2014	4/10/2014	5/1/2014	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/3/2014	12/1/2014	1/6/2015
Pam.(b) (6)	Pam. River		1/3/2014	2/4/2014	3/20/2014	4/10/2014	5/1/2014	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/3/2014	12/1/2014	1/6/2015
Pam.(b) (6)	Pam. River		1/3/2014	2/4/2014	3/20/2014	4/10/2014	5/15/2014	6/2/2014	7/26/2014	8/12/2014	9/11/2014	11/7/2014	11/15/2014	12/1/2014	1/6/2015
Chick. Bridge	Chick. River		seasonal			3/13/2014	4/11/2014	5/10/2014	6/24/2014	7/31/2014		9/9/2014		12/2/2014	1/29/2015
Chick. Bridge CC side	Chick. River					3/20/2014D	4/11/2014	5/10/2014	6/24/2014	7/31/2014		9/9/2014		12/2/2014	1/29/2015

During array operation in 2013, we faced many receiver deployment challenges. Receiver losses (30) expanded with increasing distance from shore. We believe, and in some case have evidence, that losses occurred due to vessel and dredge interactions and extreme equipment stress during unusually large storms. Twelve losses occurred during a single storm event in March 2013, when waves remained very large (2 to 6 m) for weeks. We also suffered from faulty equipment (e.g., shackles) and potentially direct removal by unknown persons in 2013. In one instance, a site on the Chesapeake Bay Bridge-Tunnel (CBBT) needed to be moved to perform bridge maintenance. We relocated to a buoy nearby to save the location as a monitored site.

Loss and breakage of receivers were greatly reduced in 2014. Receivers in high-energy areas were wrapped in neoprene jackets and secured within 10-cm diameter conduit pipes with custom U-bolts. These were then attached with two separate stainless steel cables with 2,200-kg breaking strength, on cable extending from the top and underside of each buoy. Although this method is much more successful, it does not prevent all losses. Our largest loss of receivers occurred when six buoys and associated receivers were removed by the USCG when buoys damaged due to storms were replaced. Some of these were recovered but not all. Our communications with the USCG were subsequently improved and we have not had any problems since.

Receiver locations were mapped in terms of river mile, bay mile, or offshore distance from the Collision Regulation Line (COLREGS) to increase the applicability of telemetry data with regard to consultations with state and federal managers who use these mile markers as delineations when discussing management alternatives. Mile delineation maps are found in **Appendix 4.2 A**. Coverage by receivers within military zones based on our 0.7-km mean detection range (for a V16 tag) is presented in **Table 3.** Maps denoting estimated receiver reception coverage within each zone of military interest are presented in **Appendix 4.2 B.**

Table 3. Estimated coverage of receivers within military zones of interest. Perimeters, areas and percentage of aqautic area covered by the receiver array (based on a 0.7-kilometer estimated reception range) are presented. Receiver coverage was reduced at some sites because a portion the receiver detection range was occupied by land, therefore, percent coverage reflects aquatic coverage only.

Military Zone	Perimeter (m)	Area (m^2)	Receiver Coverage (m^2)	Percent Coverage
Naval Weapons/ Cheatham Annex	37644.2	31716399.0	5235329.1	16.5
Naval Station Norfolk	66777.0	48066219.8	14828030.6	30.8
Elizabeth River	46684.3	10249604.0	4995695.0	48.7
Little Creek	27492.8	44061016.4	9996580.8	22.7
Fort Story	18987.3	17990689.5	4438136.3	24.7
Firing Range Surrogate	84761.2	375837361.0	27698676.9	7.4

4.3 Transmitter Detection Overview

A total of 653 individual Atlantic sturgeon was detected within the receiver array from December 2012 through December 2014. Data on the number of detections at each receiver will be presented in the appropriate regional and military zone sections. Sixteen other species with sonic tags were also recorded (**Table 4**); these represent the efforts of 34 researchers from 32 different organizations. The greatest numbers of sturgeon detected were tagged north of the Chesapeake Bay (n=361), followed by those tagged within (n=263) and then those tagged in waters south of the bay (n=29), which included fish tagged as far south as Georgia.

1 **Table 4. Sonic-tagged species detected within the receiver array.**

	# of Individual Fish	# of Detections
Atlantic sturgeon	***653***	***494,445***
2013	399	78,160
2014	510	416,285
Black drum	*3*	*642*
2013	2	17
2014	1	625
Blacktip shark	*2*	*4*
2014	2	4
Blue catfish	*2*	*89*
2013	2	89
Blueback herring	*45*	*68,183*
2013	45	68,183
Bull shark	*4*	*27*
2013	3	17
2014	3	10
Cownose Ray	*27*	*1,825*
2014	27	1,825
Green turtle	*3*	*898*
2013	1	23
2014	2	875
Kemp's ridley turtle	*11*	*825*
2013	1	15
2014	10	810
Loggerhead turtle	*13*	*4,387*
2013	7	1,693
2014	7	2,694
Sand tiger shark	*156*	*2,537*
2013	120	1,217
2014	105	1,320
Sandbar shark	*19*	*1,175*
2013	19	233
2014	15	942
Shortnose sturgeon	*1*	*1*
2014	1	1
Speckled trout	*1*	*67*
2013	1	67
Spinner shark	*1*	*27*
2014	1	27
Striped bass	*46*	*14,287*
2013	14	326
2014	32	13,961
White shark	*5*	*52*
2013	3	6
2014	2	46

1

As the contract requires, Arc GIS® maps denoting the total numbers of detections by month, year, and overall are presented in the appendices. Each region has its own set of maps with their integral military zones. If a map does not appear for a given month it is because there were no detections, not because the receiver array was not in place. Detection layers can also be combined with layers describing other parameters such as bottom composition, temperature, salinity, and dissolved oxygen—factors known to affect sturgeon distribution (Niklitschek and Secor 2005). And thus layers can be built upon to provide increased insight with regard to why habitats are selected. Results in some regions at this point are meager, but this is common for the first few years of tracking research.

4.4 Results by Region and Military Zone

4.4.1 Pamunkey River Region

There were no telemetry results from within the Pamunkey River prior to our tagging of adult fish in late summer 2013. In 2014, the number of receiver sites was greatly expanded in order to attain more precise data on spawning ground locations. Sub-adult fish were present in the Pamunkey as early as mid-March through the third week of November. One sub-adult tagged in the James moved into the Pamunkey where it remained for several months. No sub-adults occupied the river above river mile 18. Nine of our native adult fish tagged in 2013 returned to the river in 2014, with the earliest detection occurring on 5 June. All returning adults were present by the third week of August. Female presence was primarily between river miles 43 and 45. Male fish moved more often with a larger range overlapping that of the females. Further information on the spawning of adults in the upper river can be found in Hager et al. (2014) and Kahn et al. (2014). Emigration of adults and sub-adults began in September and continued into October **(Table 5)** in 2013 and 2014. The only exception was one sub-adult that remained until 1 November. Maps for the region are found in **Appendix 4.4.1**.

4.4.2 York River Region (Naval Weapons Station Yorktown/Cheatham Annex zone)

All fish detected in the Pamunkey River were detected on their migrations through the York River as they passed through the channel adjacent to the Naval Weapons Station Yorktown/Cheatham Annex. Immigration of the nine returning adults from 2013 began on 1 June 2014 and ended 16 August 2014, and fish were present within the military zone for the whole period **(Figure 4)**. Native adults were not detected again within the military zone until 1 October. Emigration was completed by early November **(Table 6).** Very little is known about sub-adults and their migration patterns in the York River. Obviously, since fish are reproducing in the Pamunkey, native YOY and sub-adults are present year-round within fresh and brackish water nursery areas for several years following hatching (Scott and Crossman 1973). Two sub-adults were tagged by researchers at the Virginia Institute of Marine Science in the spring of 2014. They entered the Pamunkey for the summer and emigrated in mid-fall. Prior to this, two sub-adults were implanted as a part of this study in December of 2012 but they left the York River in the same month. In contrast, a 525-mm fish was collected at the top of the York River in February 2015, and a single fish tagged by another researcher has been recorded lower in the river within the military zone in February. These limited data suggest that sub-adults that have reached approximately 500 mm in fork length emigrate to coastal environments and thus pass through the military zone in fall through early spring. Maps are found in **Appendix 4.4.2.**

Table 5. Numbers of receptions by month in the Pamunkey River region, December 2012–December 2014. Receiver sites are listed in descending river mile.

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May 2013	June 2013	July 2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013	Total
Pamunkey River	55	Pam. 360	None	0	0	0	0	0	0	0	0	0	1,878	59	0	0	1,937
Pamunkey River	49	Pam. UPPER (b) (6)	None	0	0	0	0	0	0	0	0	64	1,367	26	0	0	1,457
Pamunkey River	45	Pam. (b) (6)	None	0	0	0	0	0	0	0	0	250	1,838	99	0	0	2,187
Pamunkey River	43	Pam. BRICK WALL	None	0	0	0	0	0	0	0	0	0	800	195	0	0	995
Pamunkey River	30	Pam. RES	None	0	0	0	0	0	0	0	0	17	251	101	0	0	369
Pamunkey River	18	Pam. (b) (6)	None	0	0	0	0	0	0	0	0	50	208	90	0	0	348
Pamunkey River	6	Pam. (b) (6) NOAA	None	0	0	0	0	0	0	0	0	0	3,568	1,781	0	0	5,349
Sum 2013				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**381**	**9,910**	**2,351**	**0**	**0**	**12,642**

Geographic Region	River mile	Receiver Site Name	Military Interest Zone		Jan. 2014	Feb. 2014	Mar. 2013	Apr. 2013	May 2014	June 2014	July 2014	Aug. 2013	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
Pamunkey River	55	Pam. 360	None		0	0	0	0	0	0	0	2,379	2,720	71	0	0	5,170
Pamunkey River	51	Pam. Top $	None		0	0	0	0	0	0	0	1,362	3,851	264	0	0	5,477
Pamunkey River	50	Pam. top 1	None		0	0	0	0	0	0	40	0	3,074	1,354	0	0	4,468
Pamunkey River	50	Pam. Rootball	None		0	0	0	0	0	0	0	1,719	5,747	928	0	0	8,394
Pamunkey River	50	Pam. Hickory Tree	None		0	0	0	0	0	0	22	1,942	5,890	408	0	0	8,262
Pamunkey River	49	Pam. H2O	None		0	0	0	0	0	0	17	1,316	4,582	333	0	0	6,248

Geographic Region	River mile	Receiver Site Name	Military Interest Zone		Jan. 2014	Feb. 2014	Mar. 2013	Apr. 2013	May 2014	June 2014	July 2014	Aug. 2013	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
Pamunkey River	49	Pam. Upper (b) (6)	None		0	0	0	0	0	0	4,606	2,074	7,804	435	0	0	14,919
Pamunkey River	49	Pam. L. Up (b) (6)	None		0	0	0	0	0	0	94	2,983	8,308	521	0	0	11,906
Pamunkey River		Pam. Fos. Cliff	None		0	0	0	0	0	0	655	2,342	5,914	1,139	0	0	10,050
Pamunkey River	45	Pam. (b) (6)	None		0	0	0	0	0	0	485	4,295	7,417	1,537	0	0	13,734
Pamunkey River	47	Pam. (b) (6) Lower	None		0	0	0	0	0	0	1,634	5,285	10,758	2,643	0	0	20,320
Pamunkey River	46	Pam (b) (6) (b) (6)	None		0	0	0	0	0	0	not de-ployed	not de-ployed	7,069	1,352	0	0	8,421
Pamunkey River	44	Pam. poles	None		0	0	0	0	0	0	not de-ployed	not de-ployed	16,398	4,883	0	0	21,281
Pamunkey River	43	Pam. Brick wall	None		0	0	0	0	0	0	35	7,047	12,384	1,703	0	0	21,169
Pamunkey River	30	Pam. Res.	None		0	0	0	0	0	763	201	3,537	5,377	1,149	0	0	11,027
Pamunkey River	18	Pam. (b) (6)	None		0	0	0	0	0	99	427	1,471	5,306	4,154	60	0	11,517
Pamunkey River	6	Pam. (b) (6)	None		0	0	0	1,677	3,168	950	430	7,846	2,886	9,844	2,656	0	29,457
Sum 2014					**0**	**0**	**0**	**1,677**	**3,168**	**1,812**	**8,646**	**45,598**	**115,485**	**32,718**	**2,716**	**0**	**211,820**
Total					**0**	**0**	**0**	**1,677**	**3,168**	**1,812**	**8,646**	**45,979**	**125,395**	**35,069**	**2,716**	**0**	**224,462**

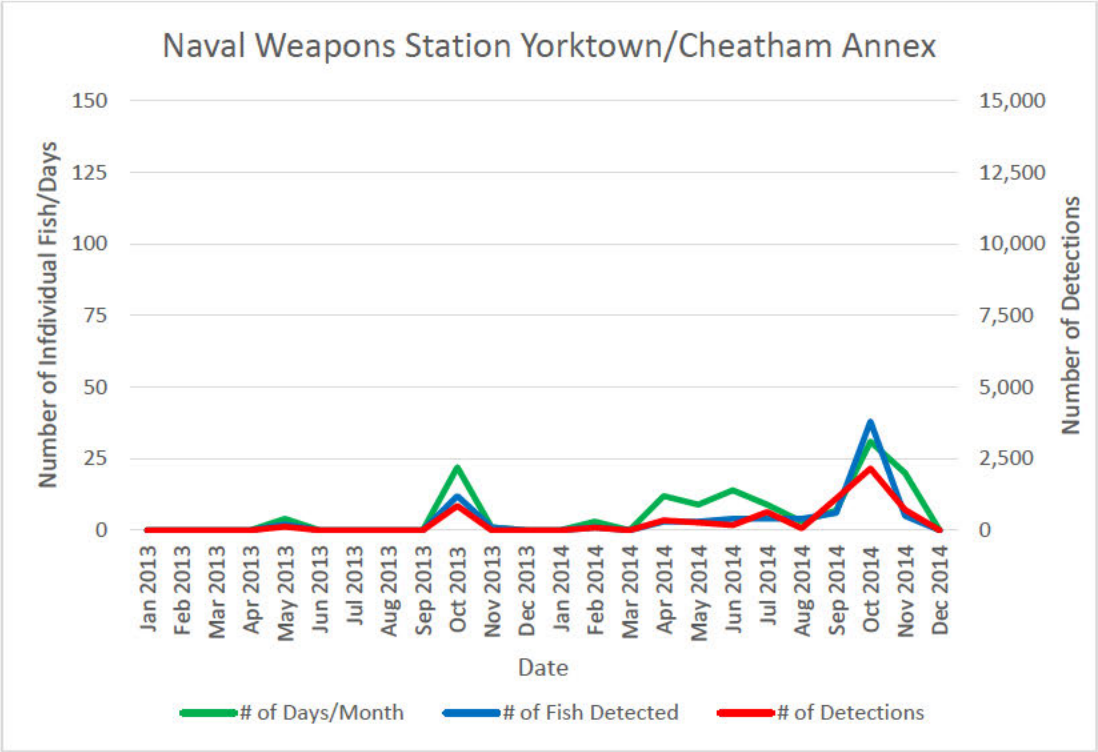

Figure 4. Atlantic sturgeon occurrence based on receiver detections in the Naval Weapons Station Yorktown/Cheatham Annex zone.

4.4.3 CHICKAHOMINY RIVER REGION

The Chickahominy River was originally monitored for a separate U.S. Navy blueback herring (*Alosa aestivalis*) study (N62470-09-D-2003). Sturgeon were present in the Chickahominy from May until October in 2013 and from April until December in 2014. The peak period in both years was from August through October when 18 sturgeon were present in 2013, and 23 sturgeon were present in 2014 (**Table 7**). Although the number of individuals did not vary greatly between years, the numbers of detections in September and October were one and two orders of magnitude greater in 2014. Further examination of reception data indicates that most of this increase was due to four sedentary sub-adults tagged in the lower James during the VIMS spring tagging effort. The vast majority of sturgeon occupying this region were adults tagged in the James River, about a fifth were adults tagged in northern systems and one fish tagged in North Carolina was detected each year. Sturgeon of varied ages using the Chickahominy River have been previously recorded (Hager 2012) and it is not unusual for fishermen to encounter Atlantic sturgeon at the river's mouth, but the 38 individual sturgeon detected in 2014 is the largest number detected thus far and the only tagged fish showing extended residence time. Future years of tracking will help determine if increase use is due to the fact that more fish are tagged or if the VIMS sub-adults, whose behavior was likely altered due to recent tagging, temporarily skewed the reception data.

The increased numbers of adult receptions recorded in the Chickahominy in late summer, accompanied by reduced movement, typify the behavior of adults observed in the upper James River from 2007 to 2011 during the same warm-water season. This observation supports the assertion that fish are seeking physiological refuge (Hager 2012). This "lazy" behavior was followed by a marked increase in mobility accompanying cooling water temperatures during October, which was quickly followed by emigration. Maps are found in **Appendix 4.4.3**.

Table 6. Numbers of receptions by month in the York River region, December 2012–December 2014. Receiver sites are listed in descending river mile.

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May-2013	Jun-2013	Jul-2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013	Total
York River	31	Y29 NOAA	None	0	0	0	0	0	0	0	0	0	20	244	0	0	264
York River	29	Y BELL NOAA	None	48	0	0	0	0	0	0	0	0	52	148	0	0	248
York River	25	Y20 NOAA	None	0	0	0	0	0	0	0	0	0	21	127	0	0	148
York River	23	Y18 NOAA	None	20	0	0	0	0	0	0	0	0	12	432	0	0	464
York River	17	Y12	None	0	0	0	0	0	13	0	0	0	0	531	0	0	544
York River	14	Y PAGE	NW/Ch.	7	0	0	0	0	9	0	0	0	0	160	0	0	176
York River	13	Y8	NW/Ch.	17	0	0	0	0	85	0	0	0	0	272	0	0	374
York River	9	Y2	NW/Ch.	0	0	0	0	0	1	0	0	0	0	37	0	0	38
York River	7	Y WAT	NW/Ch.	0	0	0	0	0	32	0	0	0	0	119	0	0	151
Sum				**92**	**0**	**0**	**0**	**0**	**140**	**0**	**0**	**0**	**105**	**2,070**	**0**	**0**	**2,407**

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Jan. 2014	Feb. 2014	Mar. 2014	Apr. 2014	May-2014	Jun-2014	Jul-2014	Aug. 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
York River	31	Y29 NOAA	None	0	87	0	293	122	113	91	13	1099	1,611	39	0	3,468
York River	29	Y BELL NOAA	None	0	48	0	281	62	17	68	6	559	2,423	80	0	3,544
York River	25	Y20 NOAA	None	0	159	0	125	48	32	108	3	388	1,756	33	0	2,652
York River	23	Y18 NOAA	None	0	72	0	81	38	29	44	8	388	1,524	55	0	2,239
York River	17	Y12	None	0	26	0	30	117	66	15	2	990	5,003	83	0	6,332
York River	14	Y PAGE	NW/Ch.	0	6	0	46	29	5	3	0	10	272	75	0	446
York River	13	Y8	NW/Ch.	0	21	0	144	224	104	215	37	906	1,044	386	0	3,081
York River	9	Y2	NW/Ch.	0	8	0	110	10	21	4	0	22	132	206	0	513
York River	7	Y WAT	NW/Ch.	0	56	0	51	11	49	418	37	172	715	53	0	1,562
Sum				**0**	**483**	**0**	**1,161**	**661**	**436**	**966**	**106**	**4,534**	**14,480**	**1,010**	**0**	**23,837**
Total				**0**	**483**	**0**	**1,161**	**801**	**436**	**966**	**106**	**4,639**	**16,550**	**1,010**	**0**	**26,244**

Note: NW/Ch. is an abbreviation for Naval Weapons/Cheatham Annex.

Table 7. Numbers of receptions by month in the Chickahomniy River region, December 2012–December 2014. Receiver sites are listed in descending river mile.

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May 2013	June 2013	July 2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013	Total
Chickahominy River	24	Chick. Dam	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chickahominy River	23	Chick. nest tree 1	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chickahominy River	22	Chick. nest tree 2	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chickahominy River	16	Chick. (b) (6)	None	0	0	0	0	0	0	0	0	93	446	217	0	0	756
Chickahominy River	3	Chick. Bridge	None	0	0	0	0	0	34	73	2	369	660	161	0	0	1,299
Sum				**0**	**0**	**0**	**0**	**0**	**34**	**73**	**2**	**462**	**1,106**	**378**	**0**	**0**	**2,055**

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Jan. 2014	Feb. 2014	Mar. 2014	Apr. 2014	May 2014	June 2014	July 2014	Aug. 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
Chickahominy River	3	Chick. Bridge	None	0	0	0	13	0	108	191	850	9,823	14,131	14	11	25,141
Chickahominy River	3	Chick. W. bank bridge	None	0	0	0	0	0	1	2	13	387	110	4	2	519
Sum				**0**	**0**	**0**	**13**	**0**	**109**	**193**	**863**	**10,210**	**14,241**	**18**	**13**	**25,660**
Total				**0**	**0**	**0**	**13**	**34**	**182**	**195**	**1,325**	**11,316**	**14,619**	**18**	**13**	**27,715**

Note: Sites are listed in a descending down river order.

4.4.4 James River Region (Naval Station Norfolk and the Elizabeth River Zones)

The Naval Station Norfolk zone was monitored by 11 receivers that covered 31 percent of its area. In 2013, 161 fish were detected in this zone and 211 were recorded in 2014. Size-range data for fish detected in the Naval Station Norfolk zone indicate that the zone provides juveniles with feeding habitats (Matt Fisher, personal communication, Delaware Department of Natural Resources), as well as being occupied by numerous adults. In contrast to the extended occupancy exhibited by age-2 fish, adults pass through the zone but do not appear to linger. Despite differences in use patterns, the zone was heavily occupied by sturgeon. In 2013, 29,181 detections were recorded, and this number grew to 86,904 in 2014. Detections occurred within the zone year-round in both years. The months with the greatest numbers of receptions were January (5,822) and February (5,288) in 2013 with receptions due to a reduced number of sedentary juvenile fish (n=5). In 2014, October had by far the largest number of fish present (n=108) and a large number of receptions was recorded (14,205, **Figure 5**). This increase in reception volume was not due to recently tagged sub-adults exiting the James River as one might first assume. Instead it is due to relatively few (n=2-3) fish that were tagged in North Carolina that chose to occupy the zone for an extended period of time. VIMS fish were detected but they did not significantly contribute to reception volume until November (4,817 detections).

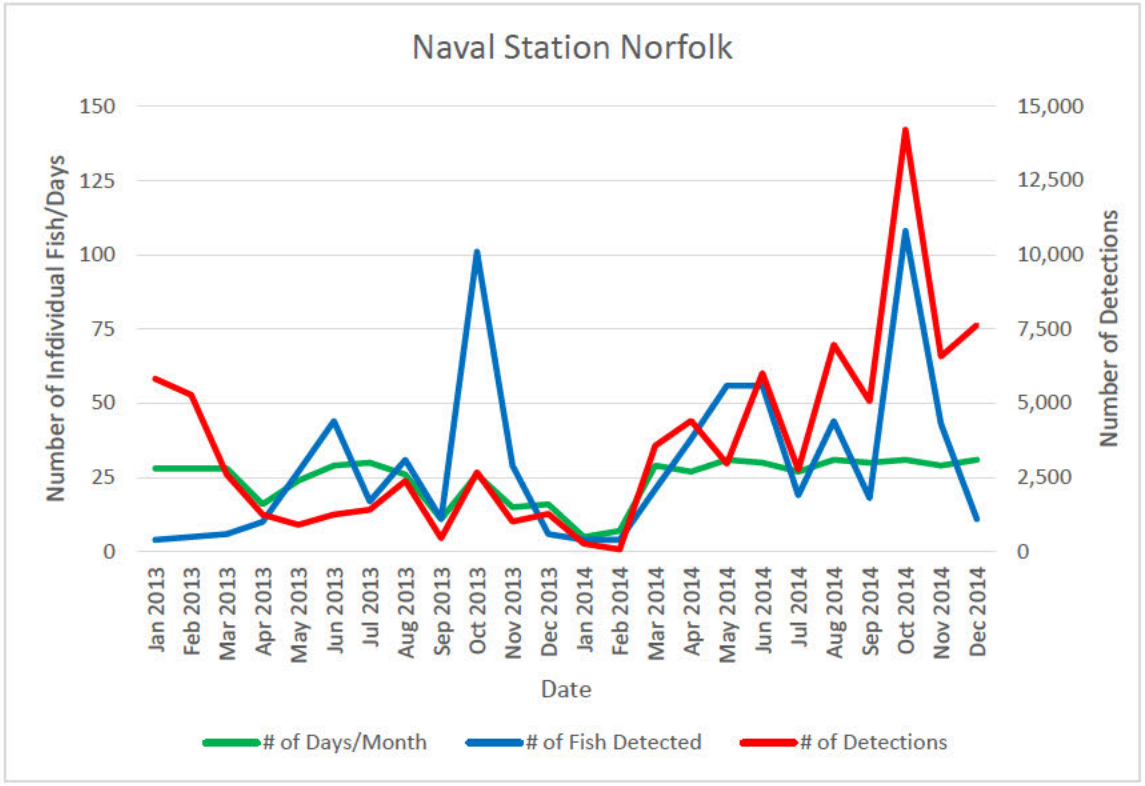

Figure 5. Atlantic sturgeon occurrence based on receiver detections in the Naval Station Norfolk zone.

The Elizabeth River was monitored by four receivers that covered 49 percent of its area. In 2013, 5 sturgeon were recorded occupying this zone: three tagged in northern systems, one in North Carolina and one in the James. The zone was occupied from late May through July. The month with the greatest number of detections was June **(Table 9)** and these were from a single fish tagged in North Carolina. In 2014, 22 sturgeon were recorded half were from the James with only two sub-adults tagged by VIMS detected and both had short residence periods. Ten fish were tagged in northern systems and one was again from North Carolina. In 2014, fish were within the zone from March to June and from July through October. The largest number of detections occurred in August and were attributed to 10 fish: 6 tagged in the James River and four from northern waters. The greatest numbers of fish occurred in July 2013 (n=2) and in August 2014 (n=10). The graph of the number of detections and days reflects the short duration and reduced sturgeon population within the zone **(Figure 6)** despite it being the zone with the greatest percent of its area being monitored by receiver coverage. No fish went upriver past the last Elizabeth River station (NH36) without returning to the Norfolk zone; therefore, there is no evidence in 2013 or 2014 that the Elizabeth River is being used as a passage into North Carolina waters through the inland waterway. Maps indicating detections by month are presented for both the Norfolk Naval Base and Elizabeth River zones in **Appendix 4.4.4.**

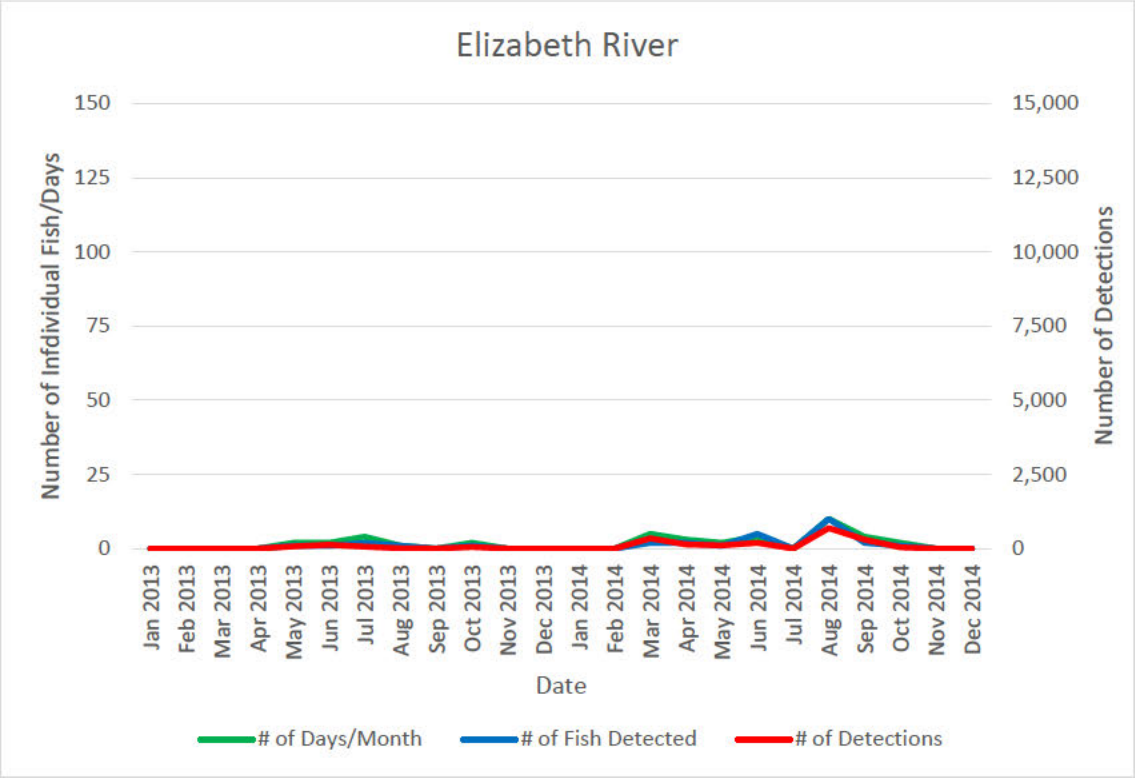

Figure 6. Atlantic sturgeon occurrence based on receiver detections in the Elizabeth River.

4.4.5 Lower Chesapeake Region (Little Creek and Fort Story Zones)

The Chesapeake region contained 26 receivers that formed an irregular gate across the mouth of the Chesapeake Bay, extending up both the Baltimore and Thimble Shoal Channels **(Appendix 4.2 B)**. Annual reception totals grew from 7,534 in 2013 to 32,149 in 2014. This increase was not due to the sub-adults tagged during the VIMS spring tagging effort nor any other fish tagged in the Chesapeake region. Instead it appears to have been in large part due to an influx of fish tagged in southern locations and their inactive summer behavior. Reception numbers in the lower Chesapeake region were largest in June in 2013 (1,693) and in July in 2014 (9,635), with most receptions occurring at the bay's mouth within the deep water sections of the Baltimore Channel from B9-B15. This apparent thermal refuge site is not within any zone of military interest. However, a closer examination of similar data in the Little Creek zone section suggests that similar patterns of habitat occupation also occur there. General increases in receptions throughout the lower Chesapeake region in the spring and fall record fish migrating through the mouth of the bay and clearly mark the region's importance as a migration corridor **(Table 9)**.

4.4.5.1 Little Creek Zone

Both the Little Creek and the Fort Story Zones occur within the lower bay region along the southern side of the Chesapeake Bay **(Figure 1)**. Little Creek is monitored by seven receivers that cover 23 percent of its area. As these zones are southeast of the mouth of the James River, they thus receive a large volume of fresh water which turns right as it exits the James River due to the Coriolis effect. The benthos of this zone is characterized by extensive sandy shallows bordered by the Thimble Shoal Channel to its north.

A total of 163 sturgeon was recorded in the Little Creek zone in 2013, and this number grew to 207 in 2014. Although much smaller in area and receiver number, the number of detections recorded in the Little Creek zone (39,153) was nearly equal to the number of detections recorded in the lower Chesapeake (39,683) **(Table 10)**. Sturgeon appear to slow their movements and take up residence in the zone during June. Fish numbers decrease subsequently but a pattern of immobility results in increased detections. Though fish numbers during the heat of summer in 2014 were lower than those recorded in 2013, the number of detections was far greater, indicating that these fish were not leaving the zone. In 2013, these fish were of northern origin. In 2014, a similarly small number of sturgeon of southern tagging origin were responsible for a very large number of receptions. The greatest numbers of detections occurred at receiver sites located along the Thimble Shoal Channel (TS11, 14 m deep; TS9, 14 m) in both years. This habitat selection pattern mimics that observed just north, in a similar region of the Baltimore Channel, between buoys B9–B15. Peak receptions occurred during identical warm-water months and the locations are similar in that they consist of deep channels that are restricted in downstream flow by the Chesapeake Bay Bridge-Tunnel. There were also a relatively large number of detections recorded at the CBBT5 site in both years. This site located on the Chesapeake Bay Bridge-Tunnel is relatively deep hole (9 m) in comparison to the shallow (2-3 m) sandy flats which surround it. Though sturgeon are known to prefer deeper habitats (Moser and Ross, 1995; Savoy and Pacileo 2003), it remains unclear as to why. Peak occupancy periods within the zone occurred in June and October in both years **(Figure 7)**. June residence was evidenced in both years and marked by congruent peaks in detection number, number of fish, and days of occupancy. Emigration was clearly marked by increases in all three metrics in October but spring immigration data is less clear between years. In 2014, migration periods are clearly evidenced in the spring and fall by peaks in fish number. In 2013, the spring immigration period is less pronounced due to a reduced number of available fish. Some of the increase in fish presence in 2014 is due to the emigration of sub-adult fish recently tagged by VIMS in 2014. In addition, a large number of fish (n=51) recorded exiting the James River carrying VCU tags in October of 2013, bolstered the number sturgeon available to be tracked in the spring of 2014 which increased the detectability of the spring immigration.

Table 8. Numbers of receptions by month in the Naval Station Norfolk and Elizabeth River region, December 2012–December 2014. Receiver sites are listed in descending river mile. It should be noted that one of the sites (N14) which is within the Naval Station Norfolk Zone actually occurs within the mouth of the Elizabeth River and is thus listed at the bottom of the table since sites are listed in descending river order.

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May 2013	June 2013	July 2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013	Total
James River	5	NN8	Naval Station Norfolk	134	13	3	217	18	46	68	60	165	26	276	75	15	1,116
James River	5	NH10	Naval Station Norfolk	17	9	52	57	14	19	69	93	49	17	52	55	0	503
James River	5	NH12	Naval Station Norfolk	0	0	149	0	0	26	22	96	21	9	38	14	0	375
James River	5	NH14	Naval Station Norfolk	0	0	170	0	0	23	24	54	14	6	9	0	40	340
James River	4	NH8	Naval Station Norfolk	603	732	140	750	163	87	115	161	128	83	82	125	10	3,179
James River	4	NN5	Naval Station Norfolk	2,140	1,585	277	1,330	768	35	53	66	69	4	270	19	26	6,642
James River	3	NH5	Naval Station Norfolk	74	277	308	102	13	68	142	26	0	0	0	0	0	1,010
James River	3	NN2	Naval Station Norfolk	303	3,482	4,497	248	127	36	52	60	61	28	167	77	36	9,174
James River	2	NN 3ER NOAA SP	Naval Station Norfolk	0	0	0	0	25	136	166	93	240	101	67	43	61	932
James River	1	NN 1ER FWS	Naval Station Norfolk	0	0	0	0	36	197	185	250	250	123	128	76	47	1,292
James River	1	NN DANGER FWS	Naval Station Norfolk	0	0	0	0	42	103	192	201	241	58	96	35	60	1,028

James River	1	NN R22 NOAA SP	Naval Station Norfolk	0	0	0	0	63	161	265	286	1,145	62	370	85	978	3,415
Elizabeth River	7	NH36	Elizabeth River	0	0	0	0	0	1	65	0	0	0	0	0	0	66
Elizabeth River	6	NH32	Elizabeth River	0	0	0	0	0	71	53	38	0	0	0	0	0	162
Elizabeth River	5	NH29	Elizabeth River	0	0	0	0	0	6	3	11	0	0	0	0	0	20
Elizabeth River	4	APMI	Elizabeth River	0	0	0	0	0	5	15	17	14	0	0	0	0	51
Sum				**3,271**	**6,098**	**5,596**	**2,704**	**1,269**	**1,020**	**1,489**	**1,512**	**2,397**	**517**	**1,555**	**604**	**1,273**	**29,305**

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Jan. 2014	Feb. 2014	Mar. 2014	Apr. 2014	May 2014	June 2014	July 2014	Aug. 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
James River	5	NN8	Naval Station Norfolk	30	0	238	128	354	556	69	140	67	756	270	44	2,652
James River	5	NH10	Naval Station Norfolk	0	0	158	461	113	318	86	394	117	38	122	218	2,025
James River	5	NH12	Naval Station Norfolk	0	0	239	352	141	360	50	225	101	49	41	0	1,558
James River	5	NH14	Naval Station Norfolk	0	0	150	135	179	263	51	125	43	51	0	0	997
James River	4	NH8	Naval Station Norfolk	0	0	202	454	170	310	149	454	369	782	696	1,747	5,333
James River	4	NN5	Naval Station Norfolk	105	0	497	324	456	776	99	140	110	9,079	3,968	3,681	19,235
James River	3	NH5	Naval Station Norfolk	na	na	na	na	na	na	na	Na	na	na	na	na	0
James River	3	NN2	Naval Station Norfolk	7	19	397	524	114	620	113	555	297	561	810	1,595	5,612
James River	2	NN 3ER NOAA SP	Naval Station Norfolk	6	0	423	812	222	523	174	646	275	229	194	36	3,540
James River	1	NN 1ER FWS	Naval Station Norfolk	6	22	499	220	321	534	232	724	744	574	201	89	4,166
James River	1	NN DANGER FWS	Naval Station Norfolk	16	9	465	561	480	868	336	1,252	2,286	1,254	78	72	7,677
James River	1	NN R22 NOAA SP	Naval Station Norfolk	105	25	307	435	413	893	1,406	2,324	656	832	203	154	7,753
Elizabeth River	7	NH36	Elizabeth River	0	0	0	63	0	0	0	114	81	0	0	0	258
Elizabeth River	6	NH32	Elizabeth River	0	0	19	40	0	0	0	0	202	146	0	0	407
Elizabeth River	5	NH29	Elizabeth River	0	0	3	17	0	42	0	197	60	20	0	0	339
Elizabeth River	4	APMI	Elizabeth River	0	0	325	26	112	155	0	175	14	31	0	0	838
Sum				**275**	**75**	**3,922**	**4,552**	**3,075**	**6,218**	**2,765**	**7,465**	**5,422**	**14,402**	**6,583**	**7,636**	**62,390**
Total				**6,373**	**5,671**	**6,626**	**5,821**	**4,095**	**7,707**	**4,277**	**9,862**	**5,939**	**15,957**	**7,187**	**8,909**	**91,695**

Table 9. Numbers of receptions by month in the lower Chesapeake Bay, which do not occur within the Little Creek or Fort Story military zones, December 2012–December 2014. Receiver sites are listed in descending river mile.

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May 2013	June 2013	July 2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013	Total
Chesapeake Bay	10	B15	None	5	38	5	1	26	69	688	193	117	514	267	610	0	2,533
Chesapeake Bay	8	B13	None	204	12	0	40	54	50	47	16	93	177	68	17	17	795
Chesapeake Bay	8	CBBT1	None	0	1	14	0	7	12	0	0	0	0	0	0	0	34
Chesapeake Bay	8	CBBT2	None	0	15	0	62	68	47	5	2	0	0	30	10	9	248
Chesapeake Bay	8	CBBT7	None	0	0	0	8	48	57	13	0	0	0	14	8	18	166
Chesapeake Bay	8	LS	None	4	6	4	22	47	28	2	0	0	0	18	1	0	132
Chesapeake Bay	7	CBBT3	None	0	79	7	27	39	0	0	8	35	9	44	37	4	289
Chesapeake Bay	7	11 CAPE CHARLES	None	0	19	13	9	0	0	0	0	0	0	0	0	0	41
Chesapeake Bay	6	10N	None	17	37	0	36	37	115	29	9	4	0	44	4	21	353
Chesapeake Bay	5	B11	None	20	0	4	0	53	32	681	212	72	39	112	129	6	1,360
Chesapeake Bay	4	B9	None	5	0	18	29	28	33	44	24	20	7	75	107	1	391
Chesapeake Bay	4	TS5	None	35	33	13	48	121	107	102	43	42	29	0	0	21	594
Chesapeake Bay	3	B7	None	12	0	0	0	27	20	64	45	17	11	58	56	10	320
Chesapeake Bay	2	B5	None	2	4	0	33	45	33	18	14	16	15	82	51	3	316
Sum				**304**	**206**	**78**	**315**	**600**	**603**	**1,693**	**566**	**416**	**801**	**812**	**1,030**	**110**	**7,534**

Geographic Region	River mile	Receiver Site Name	Military Interest Zone		Jan. 2014	Feb. 2014	Mar. 2014	Apr. 2014	May 2014	June 2014	July 2014	Aug. 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
Chesapeake Bay	10	B15	None	na	23	0	6	78	762	2,463	1,986	2,096	4	157	240	0	7,815
Chesapeake Bay	8	B13	None	na	126	13	1	82	127	140	0	23	24	101	153	133	923
Chesapeake Bay	8	CBBT1	None	na	16	0	4	86	218	2	0	0	5	4	14	0	349
Chesapeake Bay	8	CBBT2	None	na	0	0	9	319	870	61	12	11	2	261	122	0	1,667
Chesapeake Bay	8	CBBT7	None	na	3	11	0	201	597	33	0	4	1	111	75	1	1,037
Chesapeake Bay	8	LS	None	na	0	0	0	119	212	68	3	3	3	68	20	8	504
Chesapeake Bay	7	CBBT3	None	na	3	0	67	233	250	100	78	26	0	258	373	53	1,441

Geographic Region	River mile	Receiver Site Name	Military Interest Zone		Jan. 2014	Feb. 2014	Mar. 2014	Apr. 2014	May 2014	June 2014	July 2014	Aug. 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
Chesapeake Bay	7	11 CAPE CHARLES	None	na	na	na	na	na	na	na	Na	na	na	Na	na	na	0
Chesapeake Bay	6	10N	None	na	14	11	25	389	420	63	0	0	1	82	39	7	1,051
Chesapeake Bay	5	B11	None	na	27	5	46	68	103	236	464	149	146	196	233	25	1,698
Chesapeake Bay	4	B9	None	na	66	11	26	143	140	1,435	4,608	292	615	446	1,082	210	9,074
Chesapeake Bay	4	TS5	None	na	41	88	53	108	142	543	2,391	615	322	560	144	22	5,029
Chesapeake Bay	3	B7	None	na	26	8	0	89	63	96	93	4	166	172	173	17	907
Chesapeake Bay	2	B5	None	na	17	11	49	81	89	63	0	0	5	200	116	23	654
Sum					**362**	**158**	**286**	**1,996**	**3,993**	**5,303**	**9,635**	**3,223**	**1,294**	**2,616**	**2,784**	**499**	**32,149**
Total					**568**	**236**	**601**	**2,596**	**4,596**	**6,996**	**10,201**	**3,639**	**2,095**	**3,428**	**3,814**	**609**	**39,683**

Table 10. Numbers of receptions by month in the Little Creek military zone, December 2012–December 2014. Receiver sites are listed in descending river mile.

Geographic Region	Channel mile	Receiver Site Name	Military Interest Zone	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May 2013	June 2013	July 2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013	Total
Chesapeake Bay	7	LC1	Little Creek	18	4	5	5	54	2	7	0	0	6	5	4	33	143
Chesapeake Bay	7	TS11	Little Creek	2	10	2	14	73	40	118	74	119	5	1,419	98	51	2,025
Chesapeake Bay	6	LC2	Little Creek	0	50	8	0	25	42	31	19	38	12	0	17	47	289
Chesapeake Bay	6	TS9	Little Creek	36	3	0	3	60	34	105	29	46	6	528	182	111	1,143
Chesapeake Bay	5	TS7	Little Creek	8	57	4	81	68	43	123	116	49	44	157	21	24	795
Chesapeake Bay	4	CBBT4	Little Creek	0	9	16	4	12	4	39	66	14	2	2	15	0	183
Chesapeake Bay	3	CBBT5	Little Creek	0	0	9	7	46	229	1,436	228	53	13	0	2	10	2,033
Sum				**64**	**133**	**44**	**114**	**338**	**394**	**1,859**	**532**	**319**	**88**	**2,111**	**339**	**276**	**6,611**

Geographic Region	Channel mile	Receiver Site Name	Military Interest Zone	Jan. 2014	Feb. 2014	Mar. 2014	Apr. 2014	May 2014	June 2014	July 2014	Aug. 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
Chesapeake Bay	7	LC1	Little Creek	4	5	58	61	62	18	1	4	19	213	23	5	473
Chesapeake Bay	7	TS11	Little Creek	536	306	270	101	563	436	163	114	162	279	834	802	4,566
Chesapeake Bay	6	LC2	Little Creek	13	1	14	79	46	65	16	24	25	81	109	0	473
Chesapeake Bay	6	TS9	Little Creek	73	40	70	77	176	527	6,371	9,211	4,819	314	639	343	22,660
Chesapeake Bay	5	TS7	Little Creek	6	83	69	172	176	284	166	98	43	193	146	50	1,486
Chesapeake Bay	4	CBBT4	Little Creek	4	144	5	178	91	52	24	5	2	27	79	43	654
Chesapeake Bay	3	CBBT5	Little Creek	16	1	33	358	345	1,240	39	42	53	23	39	41	2,230
Sum				**652**	**580**	**519**	**1,026**	**1,459**	**2,622**	**6,780**	**9,498**	**5,123**	**1,130**	**1,869**	**1,284**	**32,542**
Total				**785**	**624**	**633**	**1,364**	**1,853**	**4,481**	**7,312**	**9,817**	**5,211**	**3,241**	**2,208**	**1,560**	**39,153**

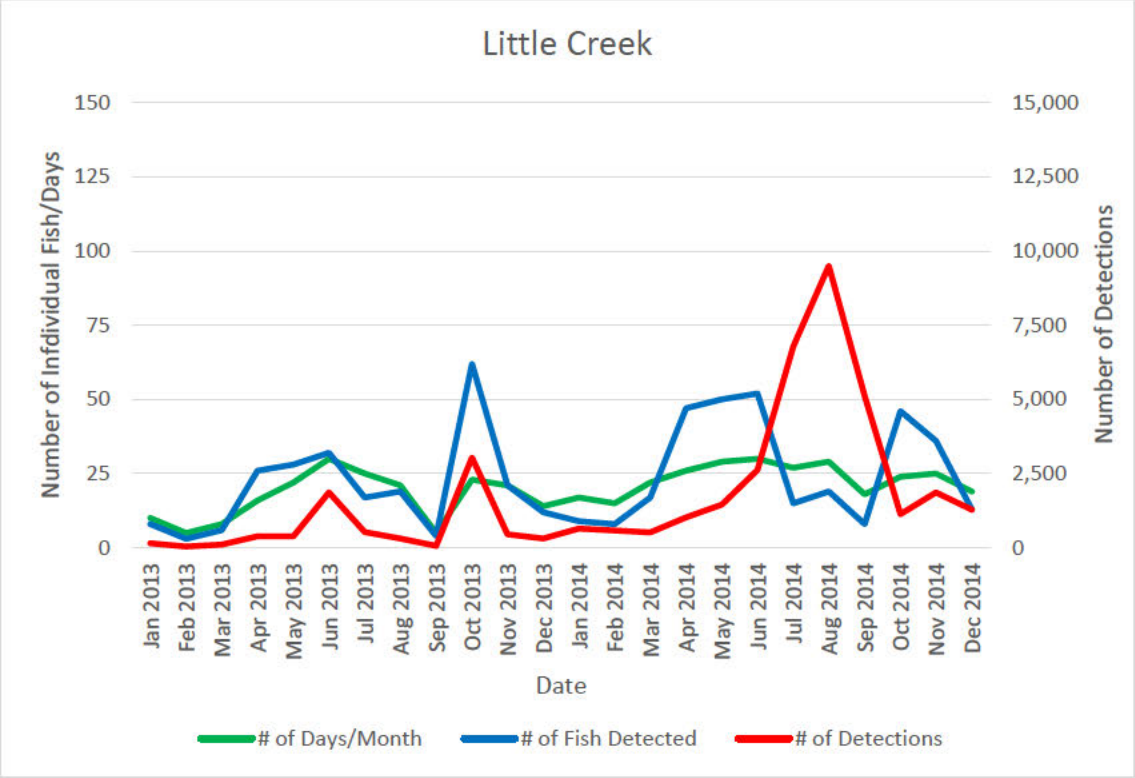

Figure 7. Atlantic sturgeon occurrence based on receiver detections in the Little Creek zone.

4.4.5.2 Fort Story Zone

The Fort Story military zone was monitored by five receivers that cover 23 percent of its area. One ocean receiver (2C off Cape Henry, defined as such because it is east of the COLREGS line) is contained within the Fort Story military zone. This zone is characterized by a deep nearshore channel located just north of Cape Henry **(Figure 1).**

A total of 174 sturgeon with 7,923 detections was recorded in 2013. In 2014, the number of individual sturgeon grew to 211 and detection number grew to 9,053. In 2013, the numbers of receptions at the Little Creek and Fort Story zones were similar (6,611 and 7,912). Although the numbers of fish in each zone remained similar (207 vs. 211) in 2014, the number of detections within Little Creek (32,542) dwarfed that recorded within the Fort Story zone (9,053); consequently, so did the total number (39,153 vs. 16,965). By far the largest numbers of detections occurred in July and August in 2013. Peaks in 2014 were in June, July and October **(Figure 8, Table 11)**. The largest numbers of individual fish detections occurred in spring and fall, concurrent with seasonal coastal migrations and immigration and emigration into the Chesapeake Bay (Hager 2012). The relatively high numbers of individuals detected combined with the reduced numbers of detections during these periods is indicative of highly mobile behavior, in this case migration **(Figure 8)**.

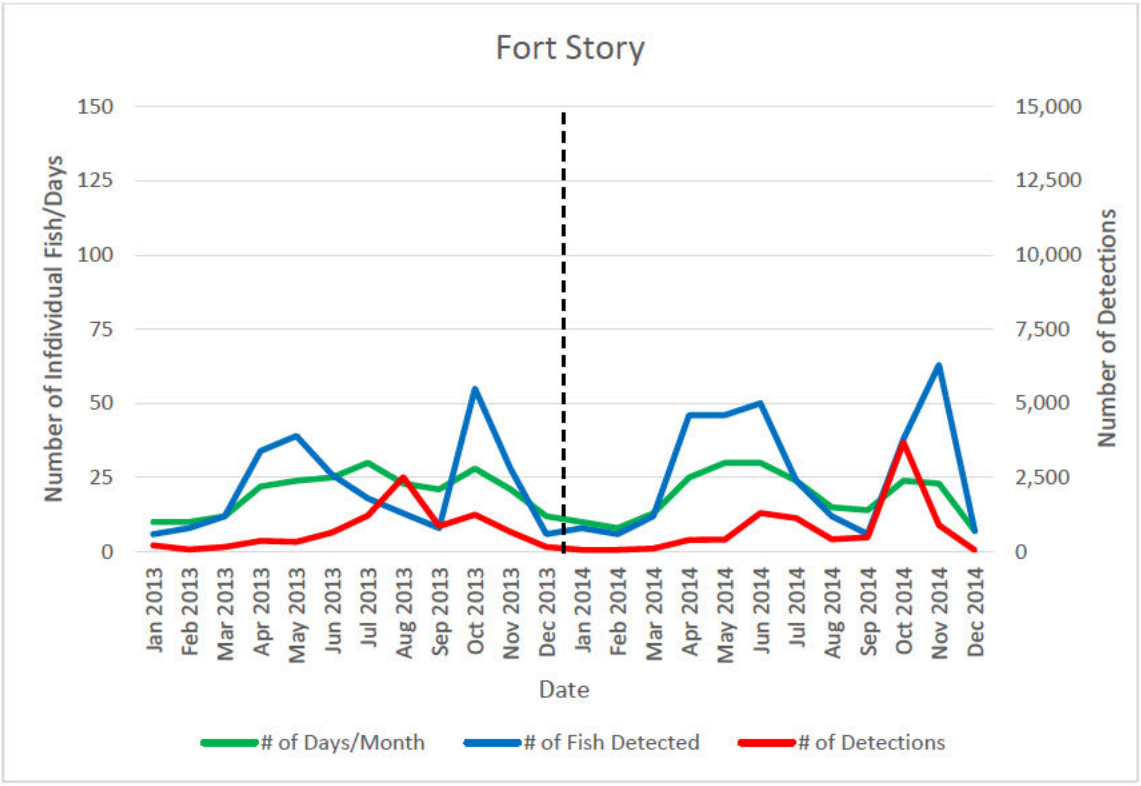

Figure 8. Atlantic sturgeon occurrence based on receiver detections in the Fort Story zone.

Table 11. Numbers of receptions by month in the Fort Story military zone, December 2012–December 2014. Receiver sites are listed in descending river mile.

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May-2013	Jun-2013	Jul-2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013	Total
Chesapeake Bay	2	TS3	Fort Story	41	103	28	52	106	50	68	52	92	23	231	308	15	1,169
Chesapeake Bay	1	2CH CAPE HENRY	Fort Story	0	10	13	60	63	60	72	49	43	71	136	81	53	711
Chesapeake Bay	1	TS1	Fort Story	8	55	10	40	95	93	442	1,125	2,358	702	430	138	73	5,569
Chesapeake Bay	1	B3	Fort Story	27	25	0	0	0	0	0	0	0	0	0	0	0	52
Atlantic Ocean	2	2C CAPE HENRY	Fort Story	17	7	0	8	88	134	64	0	19	74	0	0	0	411
Sum				**93**	**200**	**51**	**160**	**352**	**337**	**646**	**1,226**	**2,512**	**870**	**797**	**527**	**141**	**7,912**

Geographic Region	River mile	Receiver Site Name	Military Interest Zone	Jan. 2014	Feb. 2014	Mar. 2014	Apr. 2014	May-2014	Jun-2014	Jul-2014	Aug. 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
Chesapeake Bay	2	TS3	Fort Story	13	15	40	137	124	370	650	213	6	379	215	47	2,209
Chesapeake Bay	1	2CH CAPE HENRY	Fort Story	9	15	26	61	117	309	82	165	125	371	210	1	1,491
Chesapeake Bay	1	TS1	Fort Story	48	40	35	89	110	416	343	43	82	1,336	260	7	2,809
Chesapeake Bay	1	B3	Fort Story	na	na	na	na	na	na	na	na	na	na	na	na	0
Atlantic Ocean	2	2C CAPE HENRY	Fort Story	0	0	13	116	57	207	59	1	277	1,599	215	0	2,544
Sum				**70**	**70**	**114**	**403**	**408**	**1,302**	**1,134**	**422**	**490**	**3,685**	**900**	**55**	**9,053**
Total				**270**	**121**	**274**	**755**	**745**	**1,948**	**2,360**	**2,934**	**1,360**	**4,482**	**1,427**	**196**	**16,965**

4.4.6 Atlantic Region (Dam Neck Naval Firing Range Surrogate Zone)

Twenty receivers were distributed in the nearshore Atlantic region, 19 of which occurred within the Dam Neck Firing Range Surrogate zone. The array within this zone detected 280 individual sturgeon in 2013 and 347 in 2014. These are the largest numbers of tagged fish recorded in any zone of military interest, which makes biological sense in that this array records coastal-migrating sturgeon that do not have to subsequently enter the Chesapeake Bay. Sturgeon were not detected every month during both years. Each year was marked by a dearth of fish during late summer (**Table 12**), when receiver sites at the mouth of the bay show increased use and adult fish are making their journeys to riverine spawning grounds in the York (Hager et al. 2014, Kahn et al. 2014) and James (Hager 2012). Coastal migrations in this nearshore zone were extremely well defined, generally extending from March through May and October through January, with consistent peaks in April and November, respectively **(Figure 9)**. The fact that migration periods shift slightly inter-annually suggests that these migrations may be motivated by coastal water temperature. Maps are presented in **Appendix 4.4.6.**

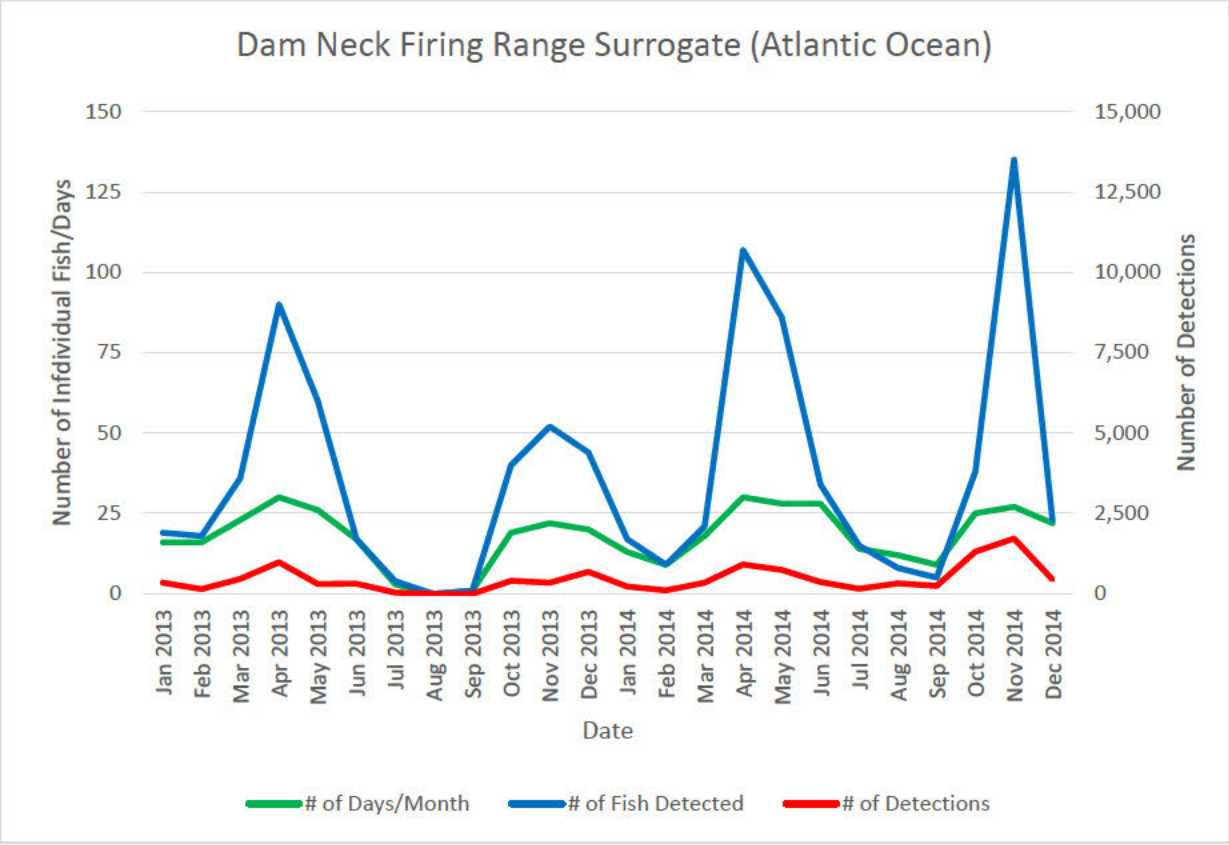

Figure 9. Atlantic sturgeon occurrence based on receiver detections in the Dam Neck Firing Range Surrogate zone.

Table 12. Numbers of receptions by month in the Atlantic region, December 2012–December 2014. Receiver sites are listed in descending river mile.

Geographic Region	Miles from COLREGS	Receiver Site Name	Military Interest Zone	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May-2013	Jun-2013	Jul-2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013	Total
Atlantic	11	NCA	None	0	1	0	0	74	31	1	0	0	0	0	0	0	107
Atlantic	14	CB	Range Sur.	26	78	12	43	95	2	0	0	0	0	0	0	57	313
Atlantic	13	CB1	Range Sur.	0	52	13	11	28	3	0	0	0	0	19	39	95	260
Atlantic	11	CB3	Range Sur.	8	22	9	47	11	9	1	0	0	0	0	28	98	233
Atlantic	10	CB5	Range Sur.	0	12	0	26	44	18	0	0	0	0	0	0	0	100
Atlantic	10	NCB	Range Sur.	0	0	1	0	46	3	4	0	0	2	0	0	0	56
Atlantic	9	CB7	Range Sur.	10	0	0	0	22	21	0	15	0	0	31	33	9	141
Atlantic	9	RA OUT	Range Sur.	1	25	10	22	27	1	3	0	0	0	29	17	0	135
Atlantic	8	CB9	Range Sur.	13	0	1	16	19	8	10	5	0	0	0	0	52	124
Atlantic	8	NCC	Range Sur.	15	5	9	7	31	35	0	0	0	0	0	0	14	116
Atlantic	7	CB11	Range Sur.	0	0	42	23	52	35	5	0	0	0	102	64	79	402
Atlantic	7	RA	Range Sur.	17	1	10	45	35	16	2	0	0	0	1	5	34	166
Atlantic	6	CB13	Range Sur.	0	0	0	19	29	42	12	0	0	0	0	0	0	102
Atlantic	6	NCD	Range Sur.	5	1	12	12	32	22	6	0	0	0	44	33	25	192
Atlantic	5	NCE	Range Sur.	16	13	0	10	21	6	0	0	0	0	0	0	0	66
Atlantic	5	CB15	Range Sur.	2	60	0	0	0	0	0	0	0	0	0	0	0	62
Atlantic	3	CH	Range Sur.	5	13	5	42	60	5	0	0	0	0	0	0	0	130
Atlantic	3	RI2	Range Sur.	16	60	11	59	214	17	8	4	0	0	0	0	23	412
Atlantic	3	RI1	Range Sur.	13	0	0	28	56	7	1	0	0	0	5	14	8	132
Atlantic	2	CH1	Range Sur.	9	14	10	35	50	22	9	9	0	0	27	13	56	254
Sum				**156**	**357**	**145**	**445**	**946**	**303**	**62**	**33**	**0**	**2**	**258**	**246**	**550**	**3,503**

Geographic Region	Miles from COLREGS	Receiver Site Name	Military Interest Zone	Jan. 2014	Feb. 2014	Mar. 2014	Apr. 2014	May-2014	Jun-2014	Jul-2014	Aug. 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Total
Atlantic	11	NCA	None	na	na	na	na	na	na	na	na	na	Na	Na	na	0
Atlantic	14	CB	Range Sur.	54	0	0	0	54	0	0	0	0	7	112	31	258
Atlantic	13	CB1	Range Sur.	0	0	0	2	41	0	0	0	0	1	36	23	103
Atlantic	11	CB3	Range Sur.	0	1	0	26	17	0	0	0	0	0	56	9	109
Atlantic	10	CB5	Range Sur.	0	17	0	0	0	0	0	0	0	5	90	15	127
Atlantic	10	NCB	Range Sur.	0	0	11	35	9	0	0	0	0	2	45	9	111
Atlantic	9	CB7	Range Sur.	0	10	0	49	18	0	1	0	0	18	40	2	138
Atlantic	9	RA OUT	Range Sur.	0	1	27	26	13	0	0	0	0	22	183	57	329
Atlantic	8	CB9	Range Sur.	0	0	26	3	11	0	1	0	0	8	63	8	120
Atlantic	8	NCC	Range Sur.	7	0	7	50	30	16	0	0	0	22	90	16	238
Atlantic	7	CB11	Range Sur.	44	23	0	0	0	0	0	0	0	117	184	9	377
Atlantic	7	RA	Range Sur.	38	0	1	20	5	20	0	0	1	264	62	27	438
Atlantic	6	CB13	Range Sur.	36	3	65	28	48	18	0	2	7	95	248	17	567
Atlantic	6	NCD	Range Sur.	0	0	0	80	23	18	0	0	0	16	44	120	301
Atlantic	5	NCE	Range Sur.	0	0	20	68	22	26	3	0	2	76	105	17	339
Atlantic	5	CB15	Range Sur.	na	na	na	na	na	na	na	na	na	Na	Na	na	0
Atlantic	3	CH	Range Sur.	0	2	36	95	127	172	136	287	232	535	191	10	1,823
Atlantic	3	RI2	Range Sur.	3	8	71	86	40	6	0	5	0	4	40	2	265
Atlantic	3	RI1	Range Sur.	35	3	60	208	166	43	0	12	2	17	77	57	680
Atlantic	2	CH1	Range Sur.	14	39	25	139	120	41	17	18	0	98	53	20	584
Sum				**231**	**107**	**349**	**915**	**744**	**360**	**158**	**324**	**244**	**1,307**	**1,719**	**449**	**6,907**
Total				**588**	**252**	**794**	**1,861**	**1,047**	**422**	**191**	**324**	**246**	**1,565**	**1,965**	**999**	**10,410**

5. DISCUSSION

As of 16 April 2013, there were 1,149 sturgeon implanted with operational 69-kilohertz VEMCO® tags along the U.S. Atlantic coast (www.theactnetwork.com). We detected 359 of those from December 2012 through January 2014. The total number of active sturgeon tags was projected to drop to 967 in 2014 due to tag expiration. In order to ensure ample sturgeon to track in the coming years, we and other researchers increased our tagging efforts within the Chesapeake Bay in 2014. Due to these efforts and others, the ACT network estimated that there were 1,359 active sturgeon tags as of April 2014 and 1,661 by January 2015. We recorded 653 sturgeon in 2014; therefore, between 39 and 48 percent of the Atlantic sturgeon known to be carrying sonic transmitters entered our receiver array. Based upon these data alone, habitats within the lower Chesapeake Bay estuary and nearshore waters appear to be extremely important to the species.

Aside from our large amount of telemetry data, several attributes of the sturgeon detected emphasize the region's importance to the species' sustainability. First, the majority of sturgeon recorded were not from native bay stocks based on the locality of transmitter implantation, spawning location and previous genetic examination of fish collected from the region (Barton et al. 2007). Second, fish were of highly varied age structure. Third, there are numerous examples of extended occupation by individual sub-adult and adult sturgeon within the Chesapeake Bay and its tributaries. Therefore, not only do the bay's tributaries support several reproducing populations of native sturgeon through the provision of spawning and nursery grounds but the Chesapeake Bay and its estuaries also sustain varied life stages of non-native stocks as well.

All but one of the Atlantic sturgeon detected in this study were captured and tagged in regions where local DPS are listed as "endangered" under the ESA. One was tagged in Maine. Only 29 of the 1,661 sturgeon detected within the array were tagged south of Virginia. Since so few sturgeon from south of Virginia were recorded using Virginia's waters, it appears the actual percentage of sturgeon we detected that originate from within NOAA's Northeast Region is likely larger than the predicted range between 39 and 48 percent. The number of individual sturgeon detected within each military zone increased with proximity to the ocean in both years. This trend is likely the result of far more implantations having occurred outside of Virginia waters than within, the species' highly migratory habits, and its extended life-history stage as a coastal transient. The number of detections within the array also increased across zones.

Zones of U.S. Navy interest in the lower Chesapeake appear to be of varied importance to sturgeon in that they serve different roles and are occupied unequally by fish of varied temporal and spatial origin. The York River appears to be unique in that it is used much less by transient fish than other zones located in closer proximity to the larger population of fish found in the James River. Data on several hundred fish tagged in the James River since 2006 suggest that fish tagged in the James River very rarely use the upper York River. Numerous fish (age 2-3) of James River origin were recorded inhabiting beds of submerged aquatic vegetation at the mouth of the York in 2006 (Hager and Musick 2007). In 2014, the array recorded one sub-adult tagged in the James by other researchers in the early spring that moved upriver through the York and remained in the lower Pamunkey for several months. This fish's behavior was highly unusual in comparison to two other sub-adults captured and released in the York River. Its sedentary behavior typifies a fish traumatized by injury. This particular track may therefore be an anomaly.

Though our efforts to delineate how fish use the York River system are ongoing, a previous lack of data was turned into an opportunity through our tagging efforts. Capture and tagging research during this study targeted spawning adult fish in the Pamunkey River to ensure that occupation patterns and migrations of native York River fish would be included in this tracking effort. The number of fish tagged in the Pamunkey River was greatly increased in 2014 and now represents a considerable portion of the estimated spawning population (Kahn et al. 2014, Hager et al. in review). These fish will provide tracking data directly applicable to the Naval Weapons Station Yorktown/Cheatham Annex zone and other zones of military interest for years to come. The collection of this data would not have been possible without directed tagging efforts. Navy funded research provided data that proved that a naturally reproducing population of Atlantic sturgeon exists in the Pamunkey River and that spawning is occurring in the fall (Hager et al. 2014). Preliminary genetic results (Tim King, U.S. Geological Survey, personal communication) also suggest that this stock is genetically unique, which could have enormous consequences for how the species is managed.

It has been suggested that adult sturgeon in the upper James River in late summer are there to spawn (Balazik et al. 2012). Tracking data from the Chickahominy River suggest that adult sturgeon seek out physical attributes that resemble those that are required for spawning like lower temperatures, reduced salinity, increased flow and higher dissolved oxygen for more reasons than reproduction. Ten adults of the 18 sturgeon detected in the Chickahominy in 2013 were tagged in the upper James River near Hopewell in September 2012. They did not return to the James River in 2013 but stopped short of suitable spawning grounds (Bushnoe et al. 2005) and spent the fall spawning period in the lower Chickahominy River. Four of these adults returned to the Chickahominy again in 2014. They were joined by ten other locally tagged adults as well as the four sub-adults tagged by VIMS in the spring 2014 whose sedentary behavior increased receptions significantly. Fish of northern tagging origin were also present (n=5) as they were in 2013 (n=3) when they were joined by a fish from North Carolina. The Chickahominy River is the largest fresh water river entering the lower James River and it is the closest to the mouth of the James River. In fact, its input is so large that it in combination with freshwater flowing down the James, an oligohaline zone is created. During the late summer when fish gather in the mouth of the Chickahominy, it is the same temperature as the surrounding James but it is higher in dissolved oxygen and fresher in comparison (www.v2.vims.edu/vecos). Unlike the upper James where fish also congregate at this time, the Chickahominy does not contain any known spawning habitat and was not included in Bushnoe et al. (2005) assessment. Therefore, the fact that adults of varied DPS origin (based on location of transmitter implantation) returned to this location during the heat of summer supports the assertion that adult fish seek out such locations at least in part for physiological reasons (Hager 2012). Sturgeon may spawn in suitable locations during the same season, but other factors are also in play and motivating residence. The other possibilities are that sturgeon are spawning somewhere in the Chickahominy River or that fish are blocked at some point from further upriver migration due to some not yet determined physiochemical blockage (e.g., relative warm water and/or lower dissolved oxygen).

The consistently larger number of fish and detections recorded within the Naval Station Norfolk zone are due to several factors inherent to the zone's receiver coverage and location. In small part, the zone's expanded receiver coverage bolsters its reception capabilities. This zone has slightly better reception coverage than other zones (**Table 3**). Though it has less coverage than the Elizabeth River, its coverage is 6% greater than that which occurs in Fort Story zone and is an 8% increase over that found in the Little Creek zone. Increased receiver coverage is in no way the whole story for the zone's higher detection rate. Its total detection number (89,554) was 42 times that recorded in the Elizabeth River zone, 5 times that of the Fort Story zone and over twice the number (16,965) documented in the preferred habitats within the Little Creek zone (39,153).

The increased detection rate recorded within the Naval Station Norfolk zone of both resident and transient sturgeon makes perfect sense from both geological and biological perspectives. Naval Station Norfolk's location at the mouth of the James River compels every fish migrating or transiting through the James River to pass through its zone. The James River historically contained a very large population of Atlantic sturgeon (Hildebrand and Schroeder 1928, Barbour 1986) and until research performed under this contract proved otherwise, it was believed to support the only remaining reproducing population of sturgeon in the Chesapeake Bay. The mouth of the James River, historically referred to as the Hampton Roads, where the Naval Station Norfolk is located, contains a naturally deep, low-salinity harbor with easy access to ocean-going deep water channels. The same physical traits that make this river's estuary/mouth exceptionally suitable as a port increase the diversity of its benthic infauna, which is indicated by its marked availability of bivalves (Mann et al. 2005). This prolific benthic community and its associated food sources likely attract Atlantic sturgeon. It is difficult at this time to determine whether the zone's occupancy pattern is dominated by transient or resident fish. Initial assessment suggests that it is most often occupied by a large number of fish for periods of short duration, which suggests that its primary use may be as a migration corridor. We also know, however, that transient sub-adults from other systems use this zone as a feeding ground. This data was provided by a pair of fish (age-2) tagged in Delaware that occupied this zone for several months shortly after leaving their native system in the winter months of 2013. Use by these very young fish may suggest that native juveniles also prefer this area, no data yet exists to support this hypothesis however since no Y-O-Y have been tagged.

Detections within the Little Creek zone in 2013 and 2014 indicated concurrent increases in fish numbers, days of detections, and the total numbers of receptions during June, a pattern that often suggests the presence of preferred habitat. Deep water sites associated with this zone and the lower Chesapeake region were also preferentially occupied during the late summers of 2013 and 2014, but the pattern in metrics changed. Fewer fish were recorded at a reduced number of stations in late summer, but since the fish present exhibited more sedentary behavior the total number of detections remained high. In both years fish exhibited sedentary behavior which can indicate thermal stress and thus site use as a seasonal refuge. In 2013, these fish occupied the sites for less duration and were of northern tagging origin. In 2014, fish were of southern origin and more sedentary and thus provided an increased number of receptions. The fact that this pattern was congruently observed in deep water sites in both the Thimble Shoal and Baltimore Channels during warm water conditions supports the thermal refuge assertion. It is unclear which characteristics cooler temperatures and/or [higher or lower?] flow rates are motivating site occupation in these channels. Interestingly, sturgeon also show a preference for a much shallower hole within the Little Creek zone where CBBT5 is located. Here detection number is much reduced in comparison with that recorded in the channels and occupation peaks two months prior to that which occurs in the deep channel mouths. Perhaps this habitat provides an increased level of benthic prey or is preferred for physiological reasons, as the region receives a large volume of fresh water outflowing from the James River and its increased depth may provide some refuge from tidal currents.

Fish appear to be moving through the Fort Story zone more often than they are residing within it. A consistently larger number of detections occur in the zone in summer, which may indicate that some fish are seeking refuge in the cooler ocean water in the lower bay. A consistent increase in the number of fish recorded in the fall likely is the result of fish migrating through the area, especially since these peaks occur concurrently within the adjacent nearshore Dam Neck Firing Range surrogate zone.

The detection pattern of sturgeon within the Dam Neck Surrogate Firing Range zone typifies that of dispersed migration. Migration through a zone or region is indicated by higher numbers of individual fish

per receiver per month with a congruently lower number of total detections per fish. The number of detection days may be reduced if the migration is of short duration or if well dispersed, the migration may occur over many days and thus the total number of detection days will not be drastically reduced. Similarities between detection patterns within the Fort Story and Dam Neck Firing Range Surrogate zone suggest increased use by transient fish at both sites. This commonality is likely due to their geographic locations. Fort Story is located along a channel leading to the largest estuary in North America and the Dam Neck Firing Range Surrogate zone is located just north of overwintering habitat for numerous Atlantic sturgeon stocks (Hager 2012; Wilson Laney, USFWS, personal communication). The fact that so many of the tagged fish detected migrating up the coast (Dam Neck Firing Range Surrogate zone) subsequently entered the Chesapeake Bay supports the assertion that Virginia's estuaries provide the species with important habitats that may be crucial to the species.

Naval Station Norfolk and Little Creek and to a lesser degree Fort Story, recorded marked increases in the number of fish detections in 2014 versus 2013. Fish migrating into or out of the James River usually pass through these zones. Without further data exploration one would suspect that the increased number of detections in 2014 was simply due to the greater number of locally tagged sturgeon, given: VIMS tagged 45 sub-adults in the lower James, 9 adults and 2 sub-adults in the York River; VCU tagged 14 adults in the upper James and this study tagged 31 adults in the Pamunkey. Analysis reveals that these fish had very little effect on the overall number of detections and that in fact detection volume was bolstered by a relatively small number of sturgeon of unusual origin.

In 2013, the majority of fish detected had been tagged locally or in locations north of the Chesapeake. In 2014, an influx of a relatively reduced number but highly influential southern fish was recorded. Though few in number, many of these fish resided within zones of Naval interest for extended periods of time. This sedentary behavior demonstrated by these fish significantly increased the total number of receptions within the Naval Station Norfolk and Little Creek zones in late summer. Similar seasonal behavior had been recorded in within sites with similar physical characteristics within these military zones in 2013 but occupant duration was much reduced and thus less significant.

It is unclear why fish of southern tagging origin were recorded in greater number in 2014, why our sites were preferentially selected, or why these fish exhibited such sedentary behavior. Inter-estuarine migrations have been extensively documented (Welsh et al. 2002; Savoy and Pacileo 2003). Non-natal estuaries are known to provide important nursery areas, foraging resources and thermal and salinity refuges (Moser and Ross, 1995). Sub-adults and adults are recorded at varied times preferentially occupying waters that are fresh, higher in dissolved oxygen, of preferred temperature and/or in deep locations of increased flow velocities. Similar site selection and behavior by sub-adults and adults has been recorded in tributaries during warm water periods and researchers have suggested it is associated with increasing water temperature (Moser and Ross, 1995; Hager, 2012). This behavior was documented in the James River (Hager, 2012) when surface water temperatures neared or even slightly exceeded the 27° C physiological temperature threshold proposed by NItlischek and Secor (2005).

Were these fish tagged in southern locations from southern DPS units or were they simply tagged there? Were these fish newly tagged, thus in these locations previously and just not detectable which implies no alterations in the Chesapeake Bay's seasonal population actually occurred? Do inter-annual shifts in the DPS composition like this occur potentially annually and our data previously just so limited that we have not recorded it? The array is very young and is too limited in its longevity to accurately document the behavior of such a highly migratory long lived species with such a complex life history; much less interpret why such behaviors are occurring given our current scope of knowledge. It will take many

more years of similar efforts to design effective tools for the efficient protection of the species within the Chesapeake Bay, especially given DPS based approaches.

6. DEPLOYMENT CHALLENGES

Our first-generation offshore receiver deployment method was an improvement upon the approach used by another Atlantic Coast researcher (Dewayne Fox, Delaware State University) and our method which we had used successfully in local rivers since 2006. Our original offshore approach doubled the amount and thus break strength of our attachment cables, but this was not sufficient to hold receivers on Chesapeake Bay or offshore buoys, where heavy traffic, narrow channels and severe storms occur. Generation Two deployment methodology was developed to address chafing issues on pilings, which became apparent after 6 months of deployment (June 2013) on the Chesapeake Bay Bridge-Tunnel. A Generation Three buoy attachment method was developed in August 2013 and deployed in September 2013 to address losses on buoys in the ocean. This attachment method placed the receiver directly below the buoy and out of the way of vessel impact and though no receivers were ever lost, it resulted in increased receiver failure due to a lack of protection from buoy receiver vibration and direct contact.

Since receivers were still failing due to water leaks, battery disconnections and/or clocks rattling off of the internal motherboard, our Generation Four approach padded the Generation Three attachment. This greatly reduced leakage, but clocks still detach despite very little detectable movement between receiver and buoy. VEMCO recognized this clock detachment as a problem and altered the battery attachment design in response. To further reduce stress on the receivers we have begun to re-suspend ocean receivers. In high energy environments, we now attach padded and incased receivers to two 6-m, 8-mm diameter stainless steel cables each with breaking strength of 2,200 kilograms. One cable attaches the receiver to the bottom of the buoy and one to the top. These cables are attached with custom stainless steel U-bolts to the receiver and buoy. In combination with VEMCO's new battery attachment methods, this approach has been working well. However, no matter how we deploy these units, some breakage and loss will occur, especially in offshore environments.

7. ACKNOWLEDGEMENTS

We want to thank the numerous researchers who allowed us to use their fish tags in this study. We also want to recognize the Chesapeake Bay Bridge-Tunnel Authority, U.S. Coast Guard, the National Oceanographic and Atmospheric Administration, U.S. Fish and Wildlife Service, and Jason Kahn for the use of their equipment, as well as the private citizens who donated their private docks and time to assist: (b) (6)(b) (6) ; (b) (6) (b) (6) (b) (6) (b) (6) and (b) (6) , Chief of the (b) (6)(b) (6) Tribe. I also want to thank Carter Watterson (United States Navy), Jason Kahn (West Virginia University and NOAA) and Jay Russo, Craig Marcuson, Tracey Massey and Kirk Moore of my crew for the work and specimen collection. They make this research possible. All sturgeon captures were done under a federal collection permit (NOAA permit 16547-01) as well as a Virginia Department of Game and Inland Fish and Virginia Marine Resource permits.

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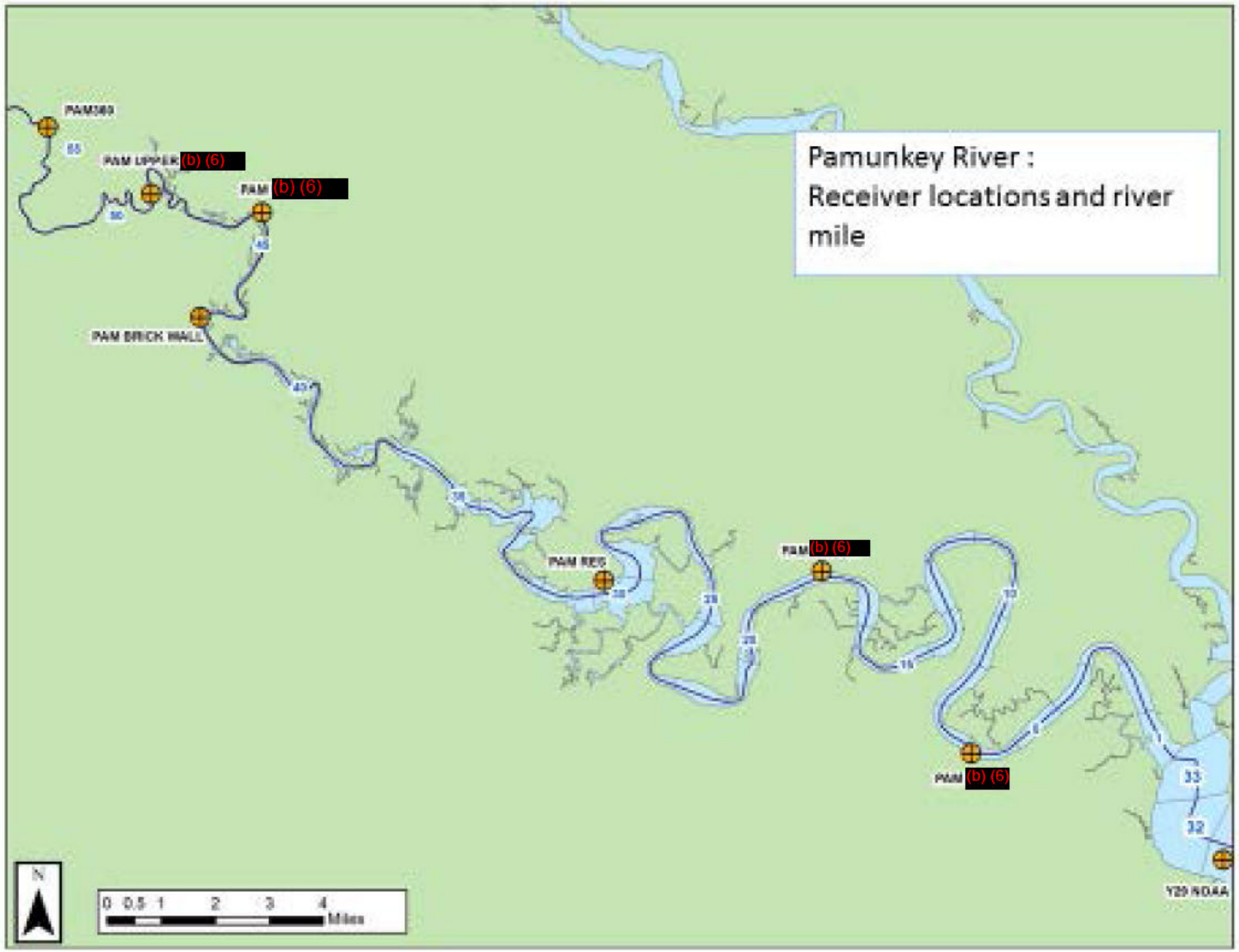
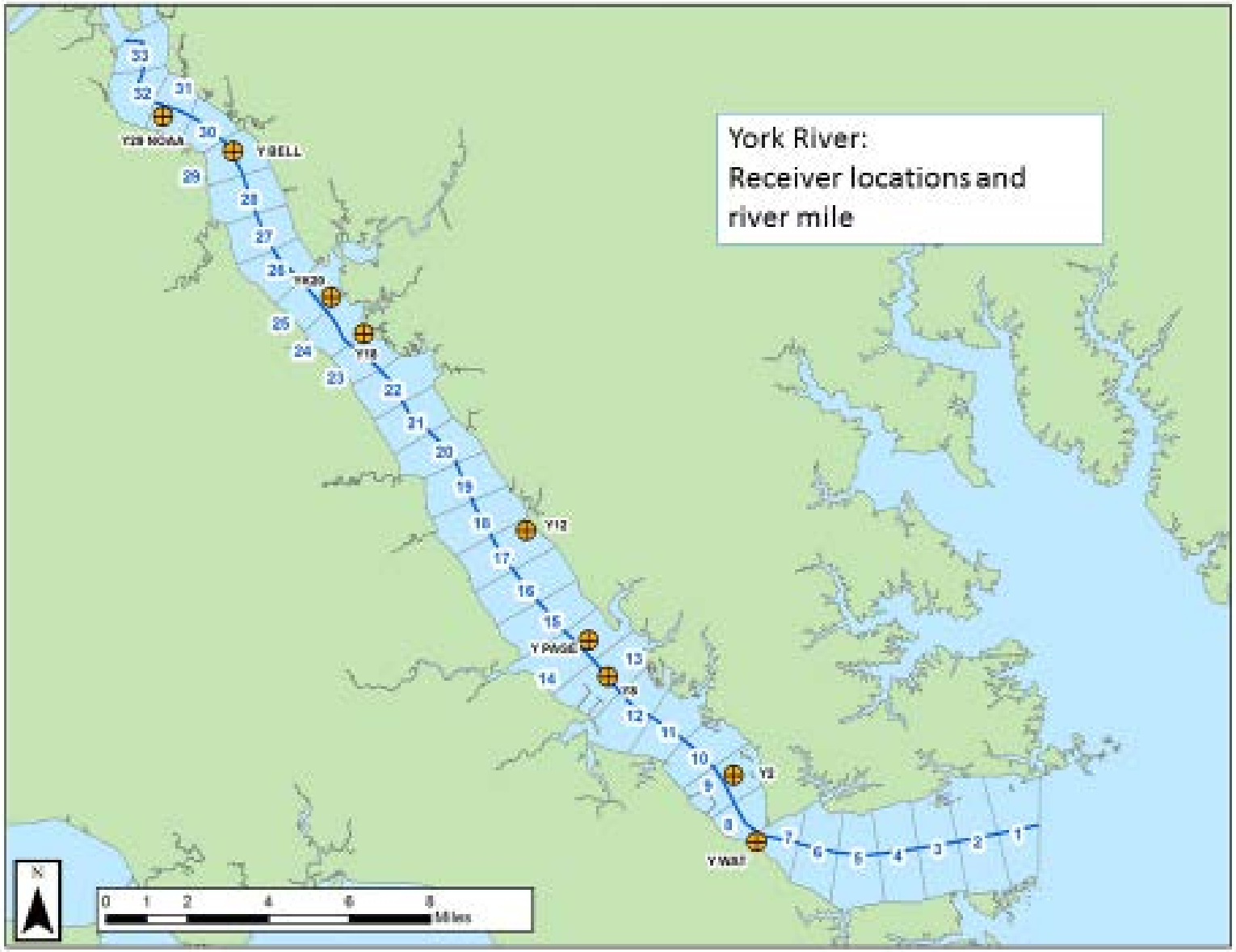
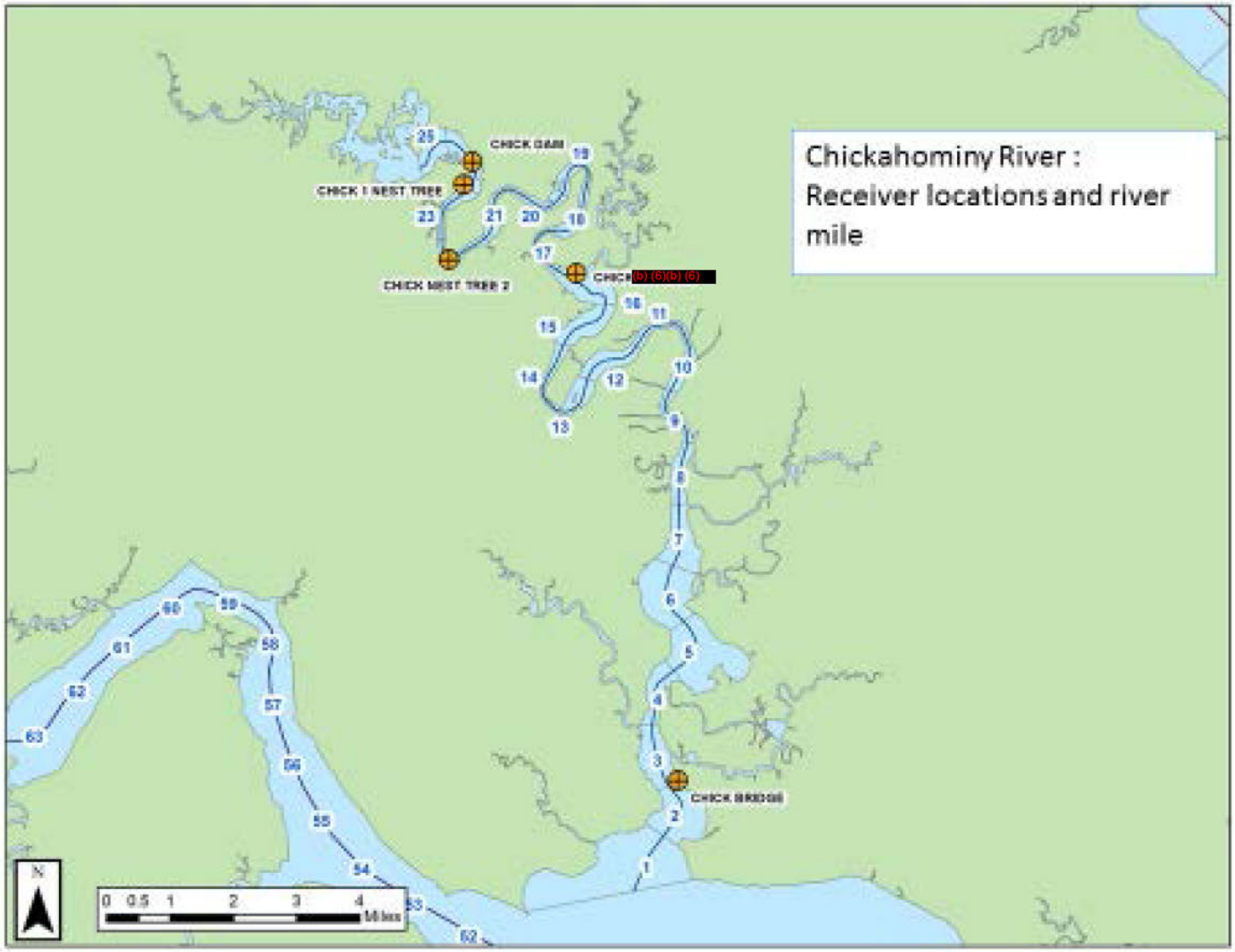
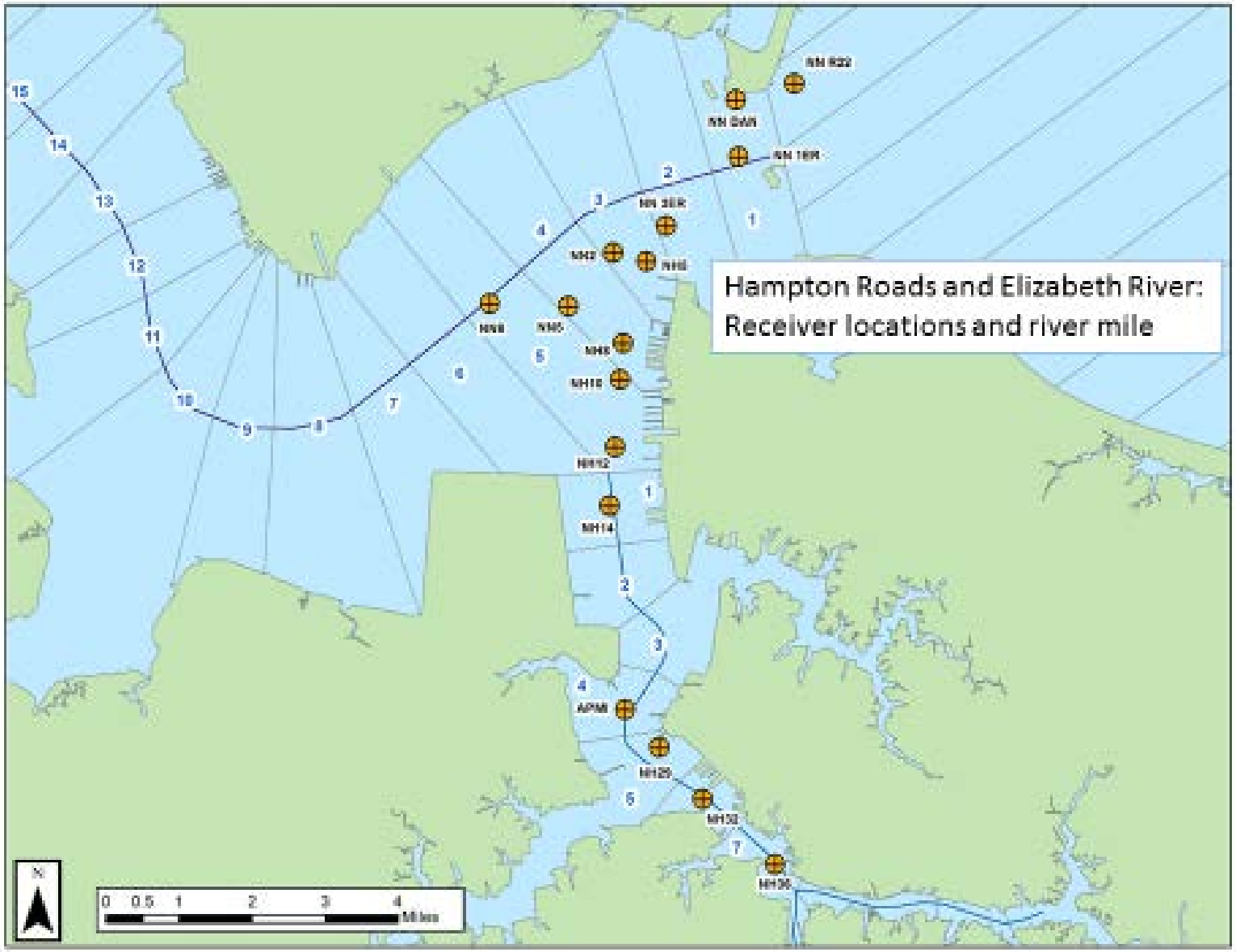
9. MAP APPENDICES

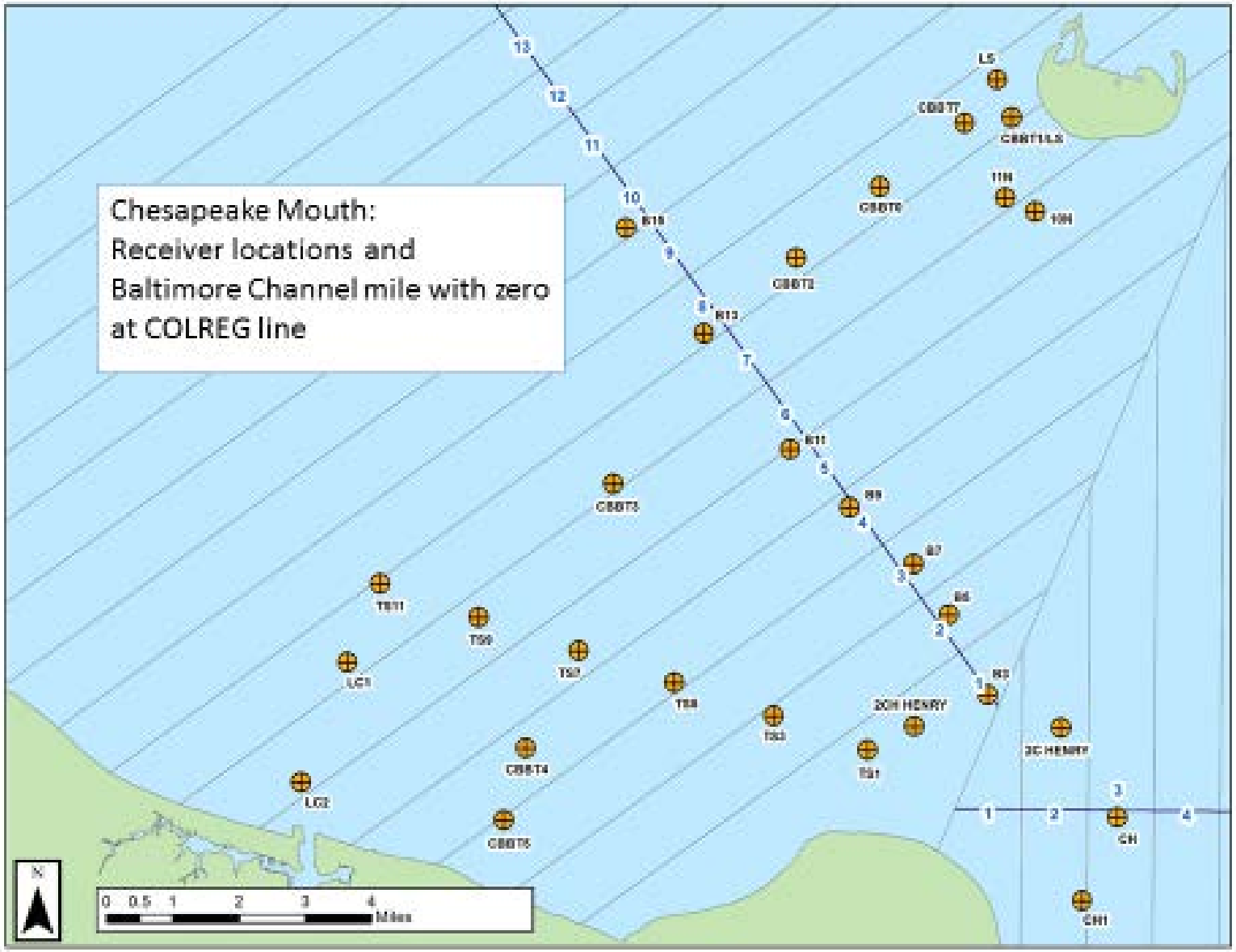
9.1 APPENDIX 4.2 A: RECEIVER LOCATIONS AND MILE DESIGNATIONS FOR EACH STUDY REGION

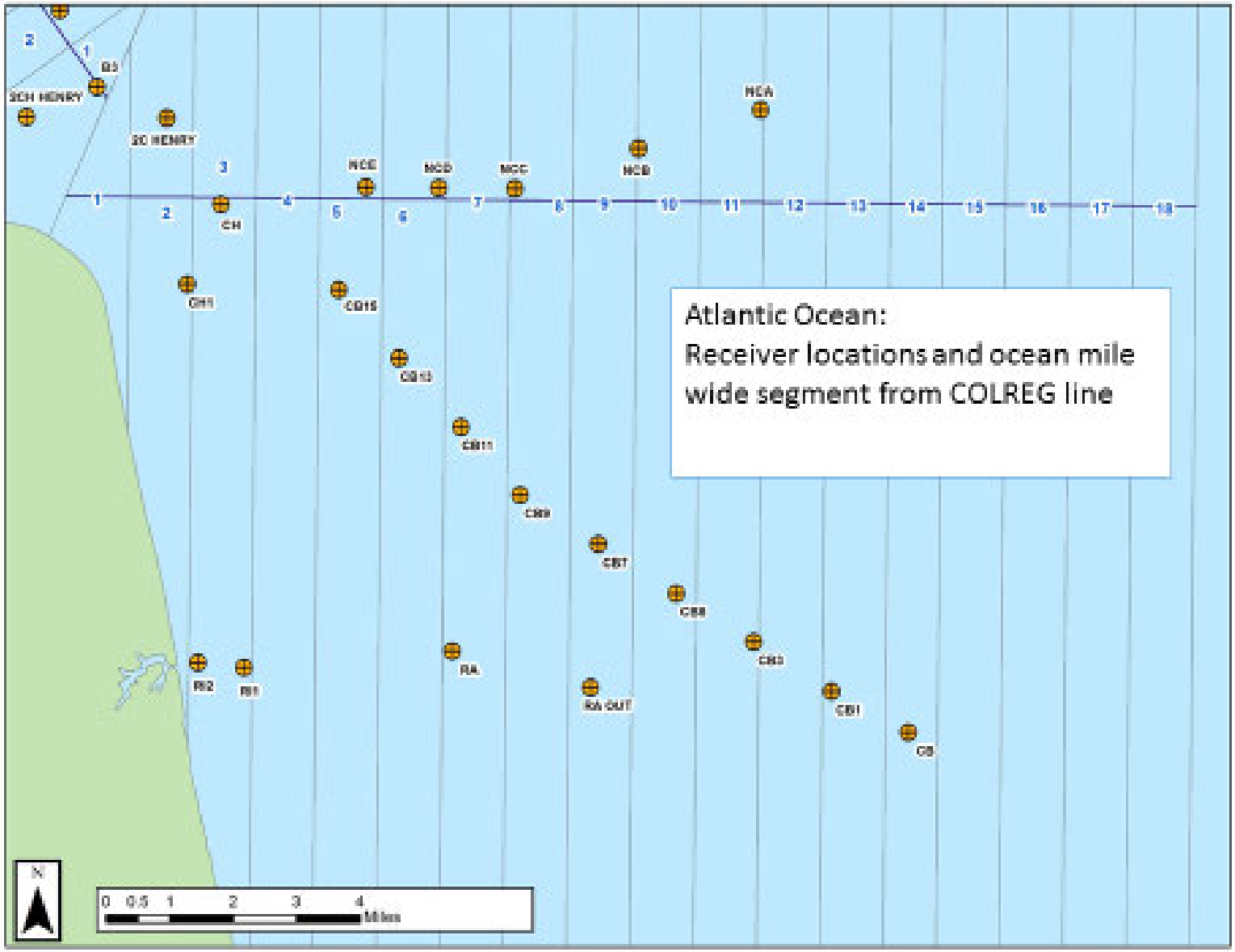



York River:
Receiver locations and
river mile
Y12
Y PAGE
Y2
N
0 1 2 4 6 8
Miles

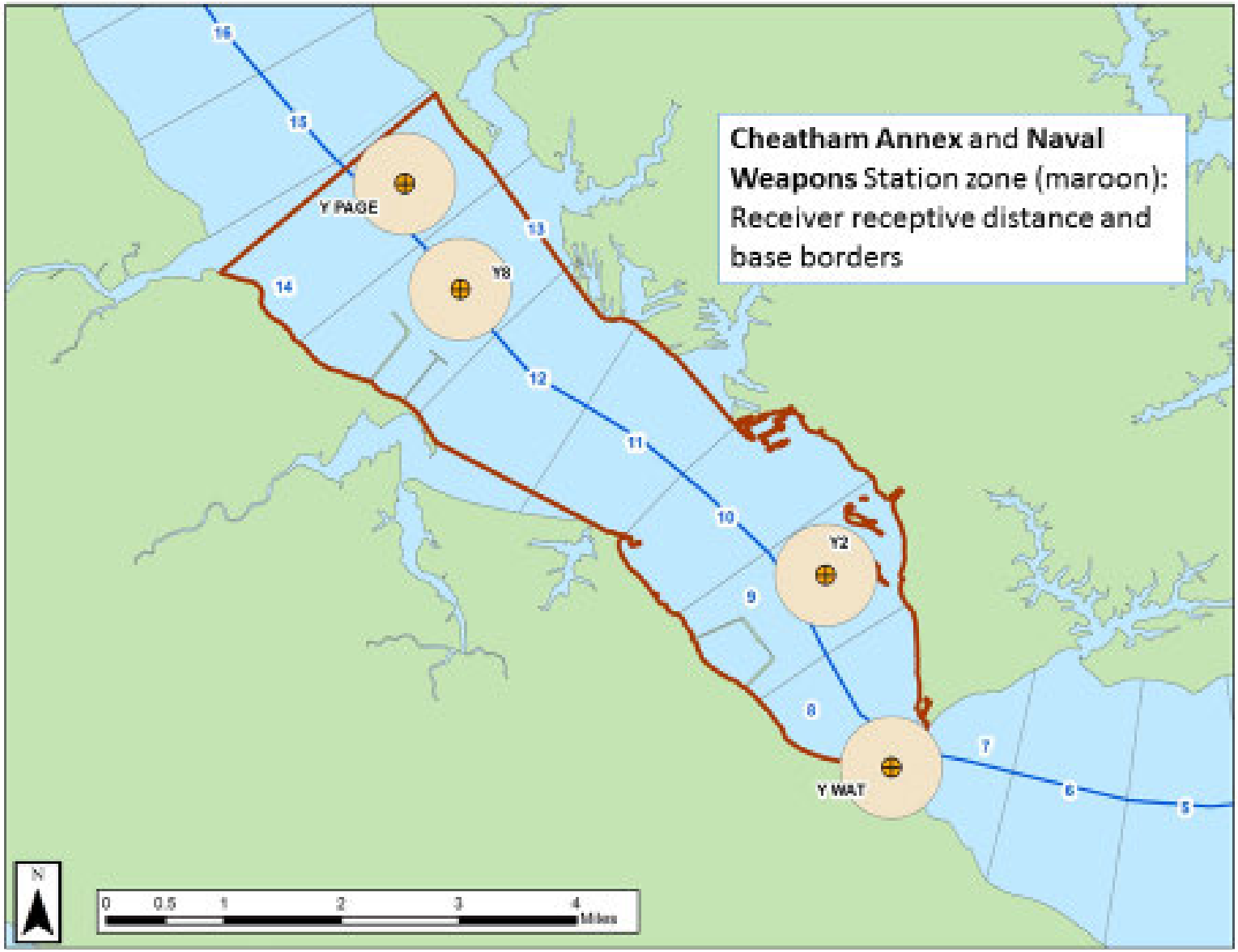

Chickahominy River :
Receiver locations and river mile
CHICK DAM
CHICK 1 NEST TREE
CHICK NEST TREE 2
CHIC(b) (6)(b) (6)
CHICK BRIDGE
25
19
23
21
20
18
17
16
11
15
14
12
10
13
9
8
7
6
5
4
3
2
1
60
59
61
58
62
57
63
56
55
54
53
62
N
0 0.5 1 2 3 4
Miles

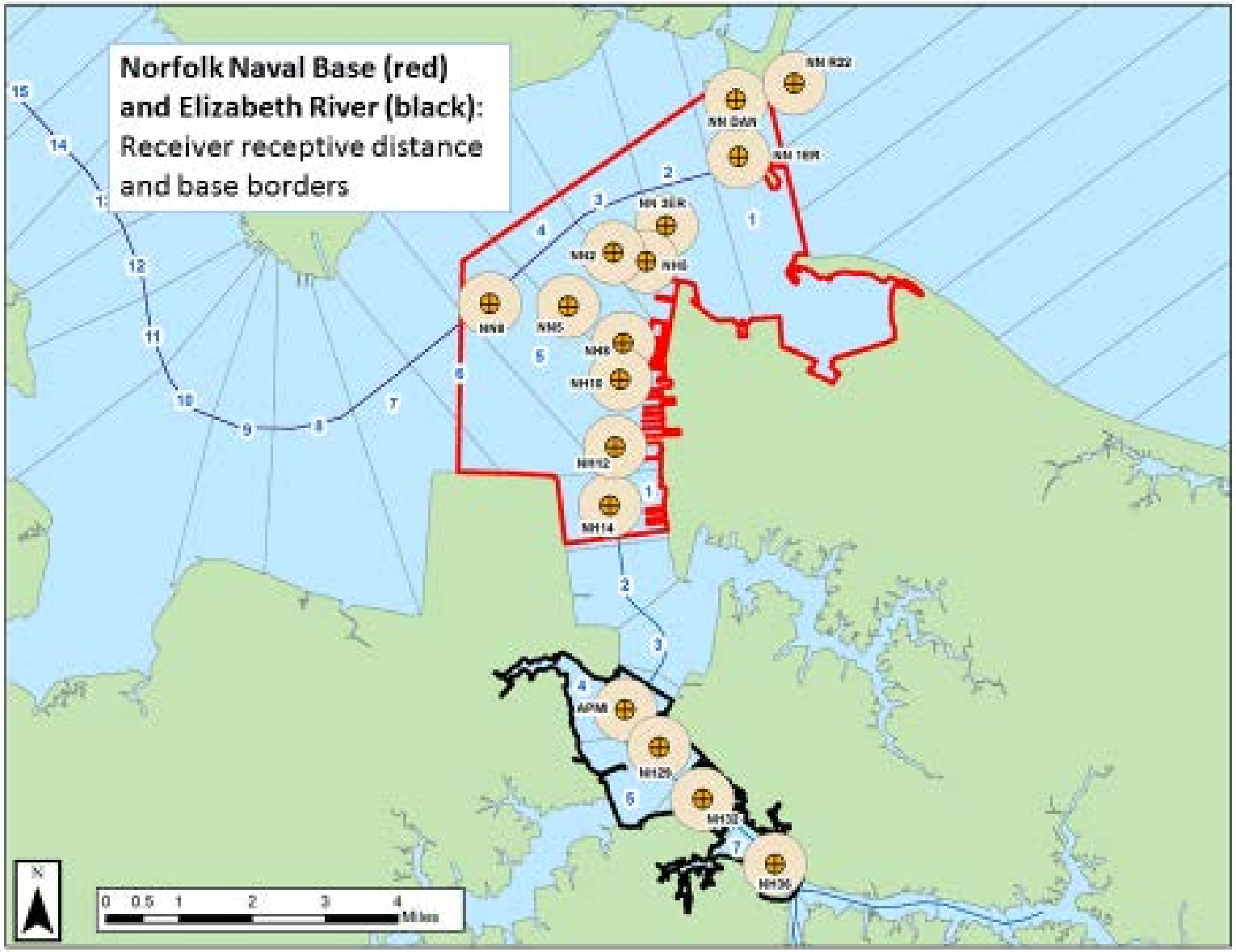

Hampton Roads and Elizabeth River:
Receiver locations and river mile
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
NN R22
NN SWR
NN 18R
NN 3ER
NH3
NH2
NN8
NN5
NH6
NH10
NH12
NH14
APNR
NH20
NH32
NH36
N
0 0.5 1 2 3 4
Miles

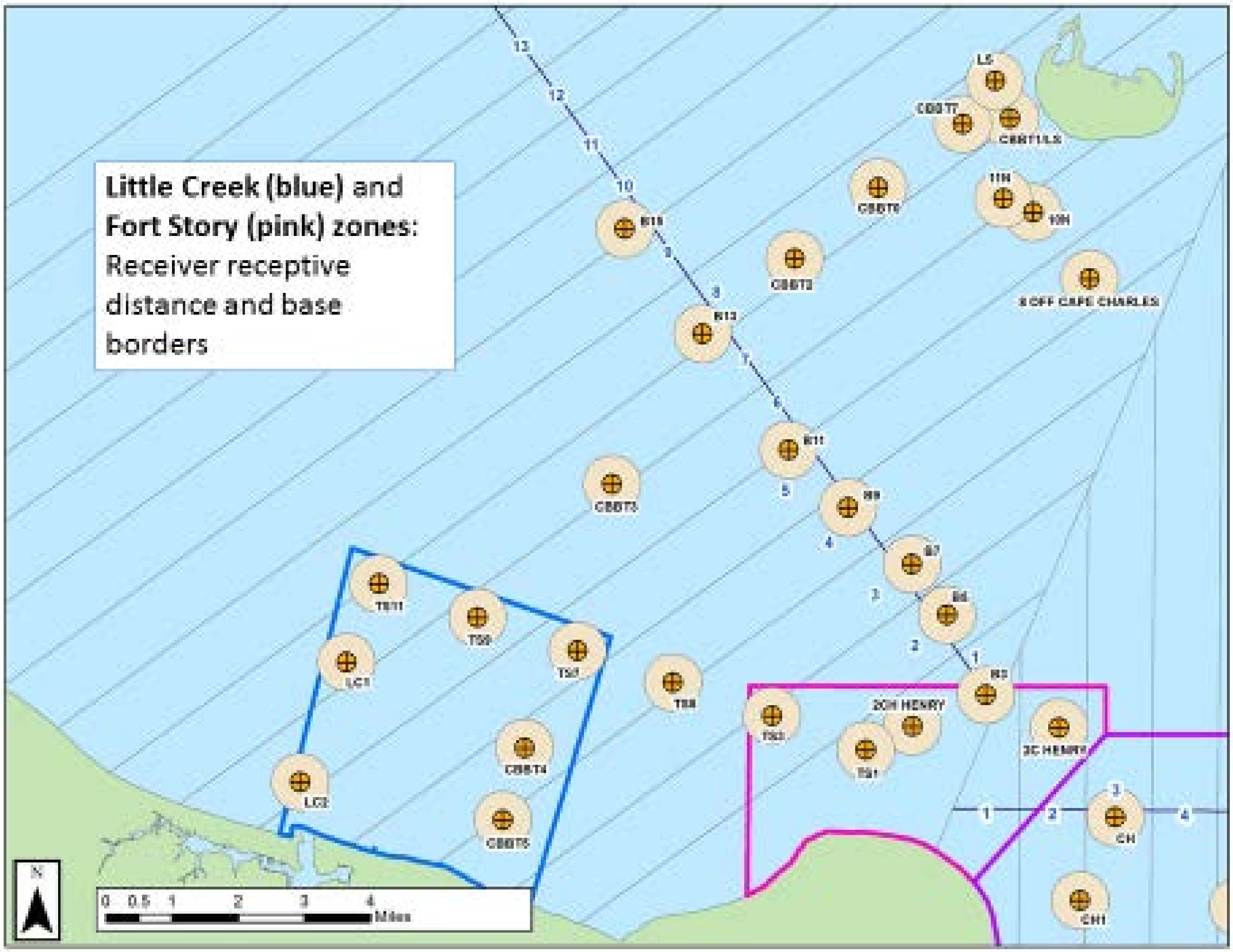

Chesapeake Mouth:
Receiver locations and
Baltimore Channel mile with zero
at COLREG line
13
12
11
10
9
8
7
6
5
4
3
2
1
R13
R11
R9
R7
R5
R3
R1
LS
CBBT7
CBBT11.5
CBBT9
11N
10N
CBBT12
CBBT10
CBBT8
TS11
TS9
TS7
TS5
TS3
TS1
LC1
LC2
CBBT4
CBBT6
3CH HENRY
3C HENRY
CH
CH1
N
0 0.5 1 2 3 4
Miles

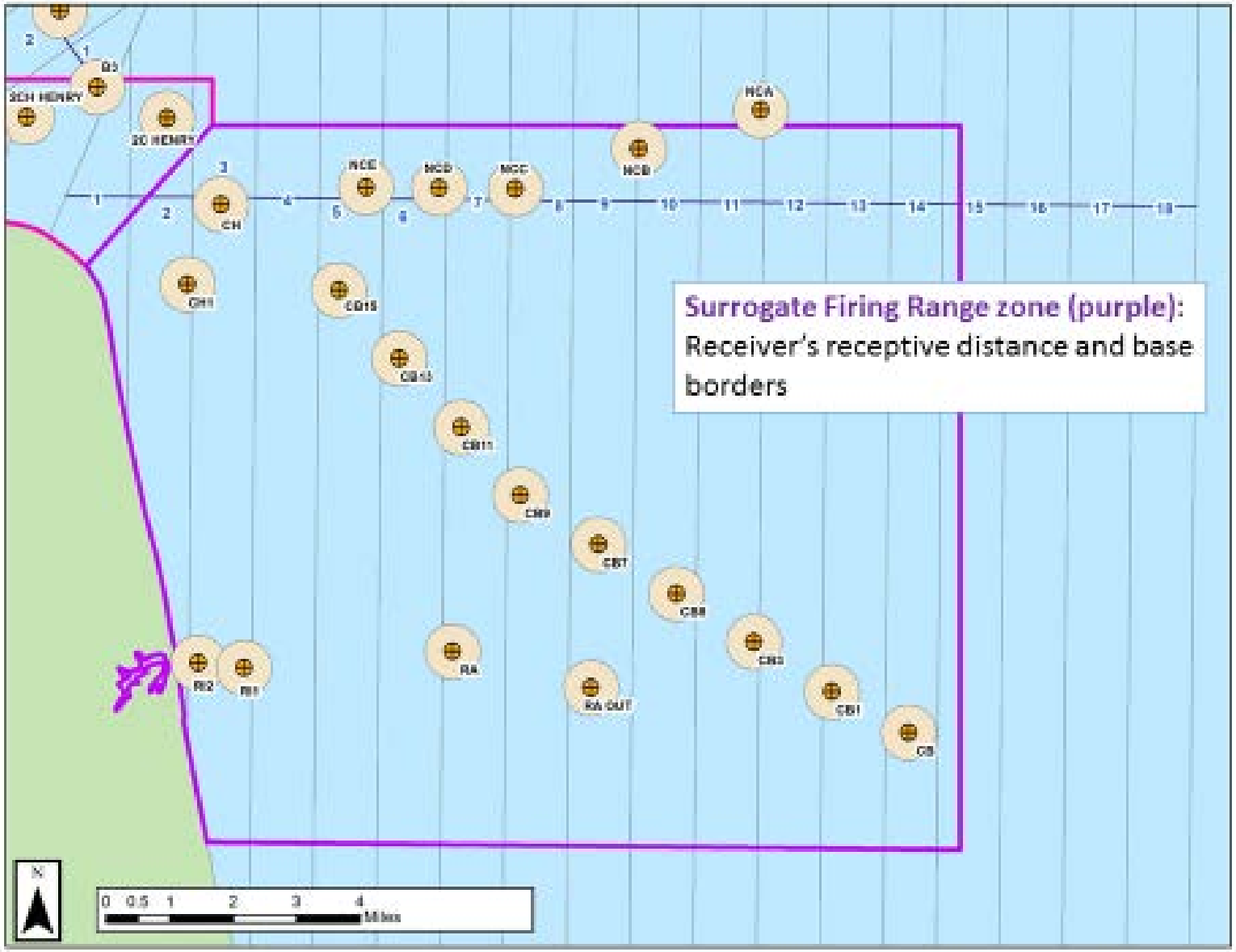

Atlantic Ocean:
Receiver locations and ocean mile wide segment from COLREG line
SCH HENRY
HCA
HCB
HCC
HCD
HCE
CH
CH1
CB10
CB9
CB8
CB7
CB6
CB5
CB4
CB3
CB2
CB1
RA
RA OUT
RB1
RB2
N
0 0.5 1 2 3 4
Miles

9.2 Appendix 4.2 B: Cheatham Annex and Naval Weapons Station Zone

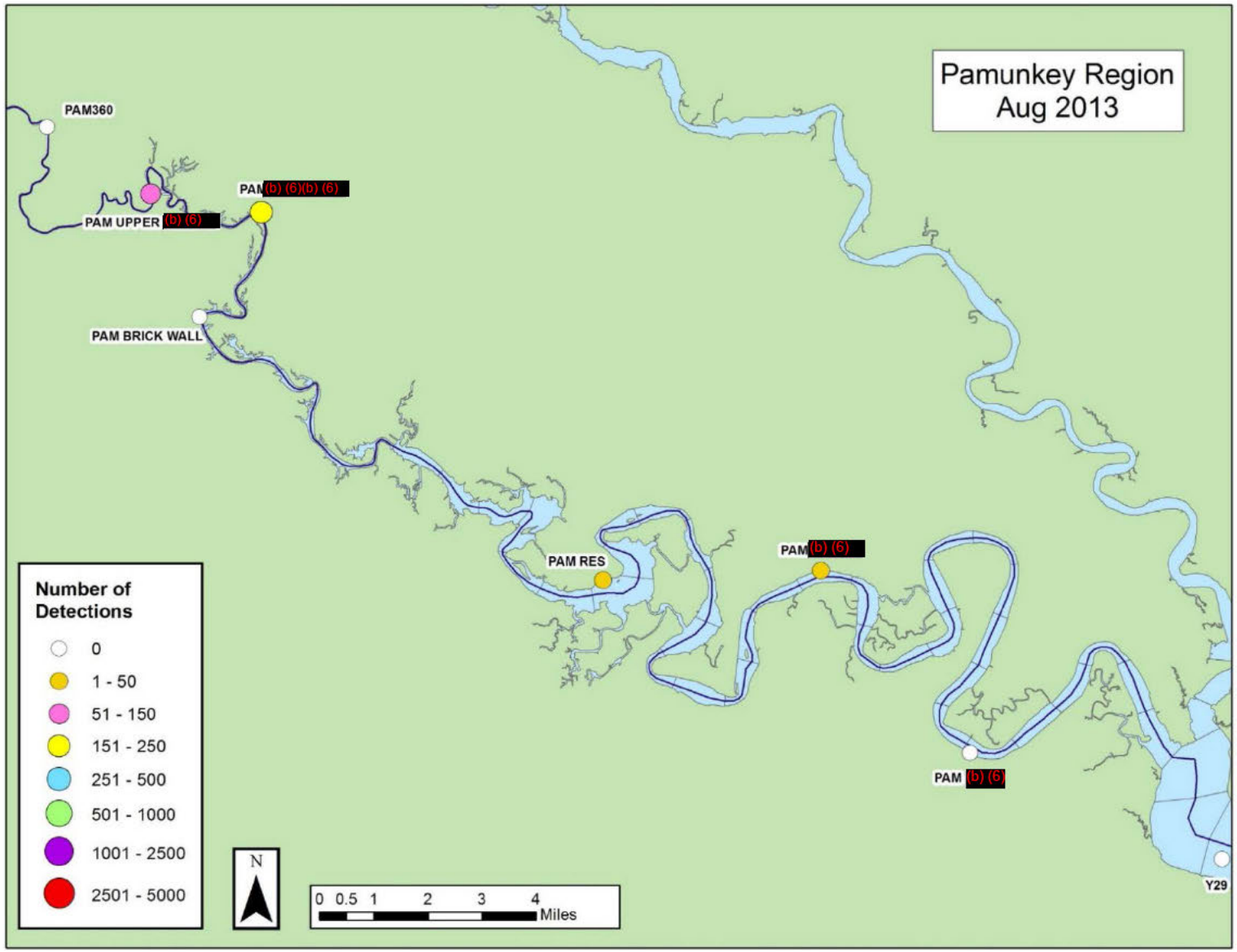


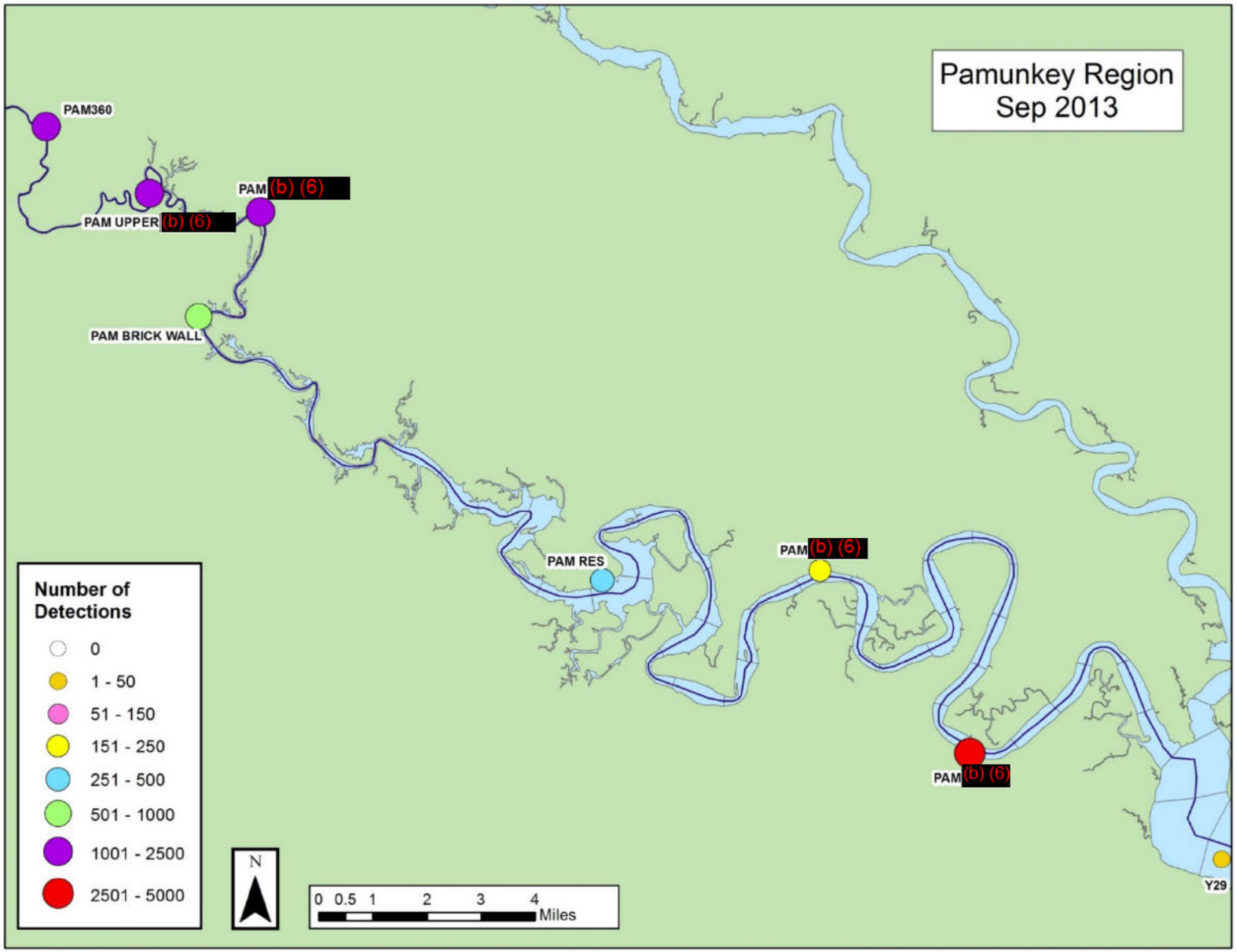

Norfolk Naval Base (red) and Elizabeth River (black): Receiver receptive distance and base borders
NN R22
NN 5WR
NN 16R
NN 3ER
NN2
NN6
NN8
NN5
NN9
NN10
NN12
NN14
APM
NN20
NN18
NN16
N
0 0.5 1 2 3 4
Miles

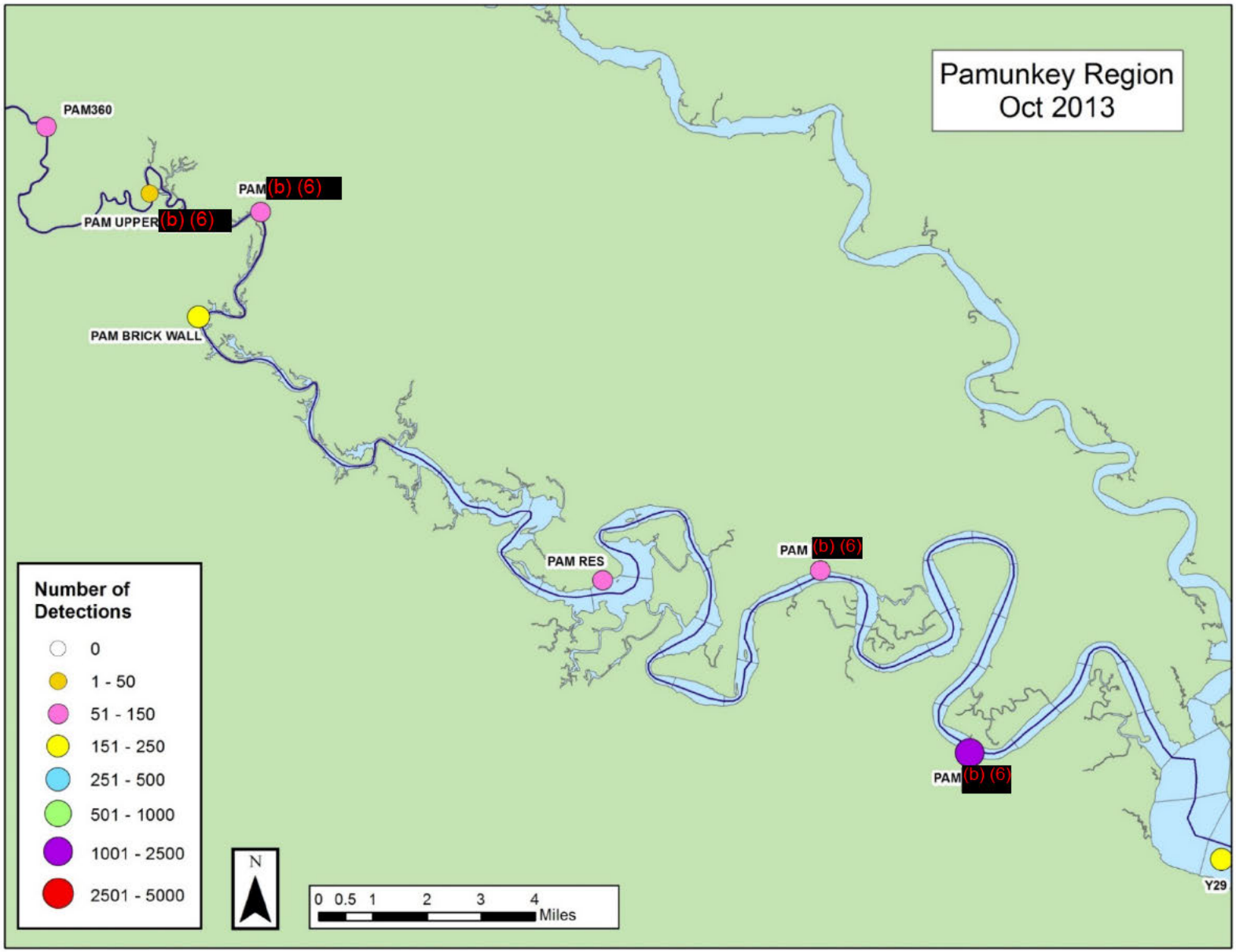

Little Creek (blue) and Fort Story (pink) zones: Receiver receptive distance and base borders
N
0 0.5 1 2 3 4
Miles
LC1
LC2
2CH HENRY
3C HENRY
8 OFF CAPE CHARLES
CH
CH1

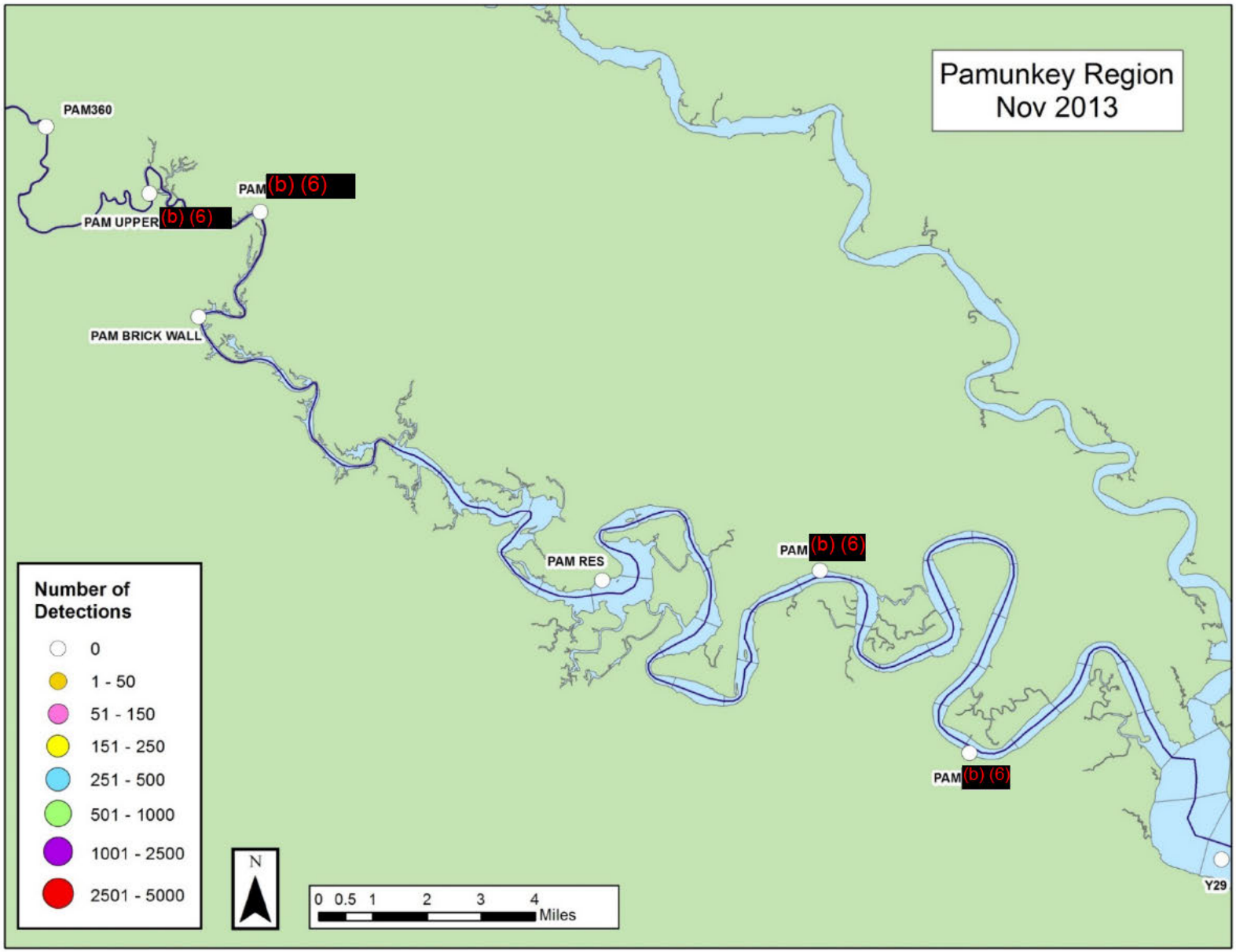

Surrogate Firing Range zone (purple):
Receiver's receptive distance and base borders
N
0 0.5 1 2 3 4
Miles

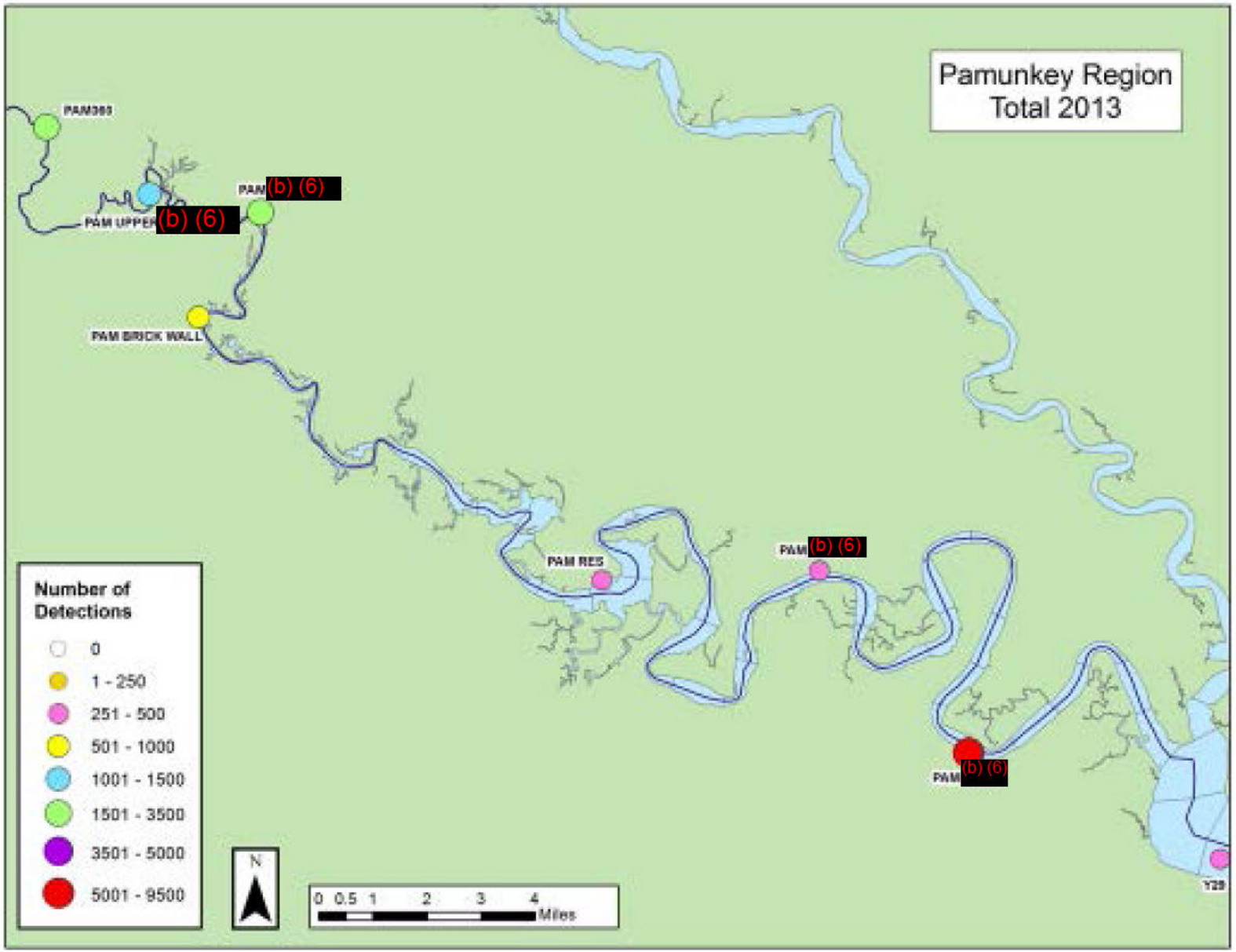
9.3 Appendix 4.4.1: Detections of sonic-tagged Atlantic sturgeon in the Pamunkey River Region, by month, year, and overall

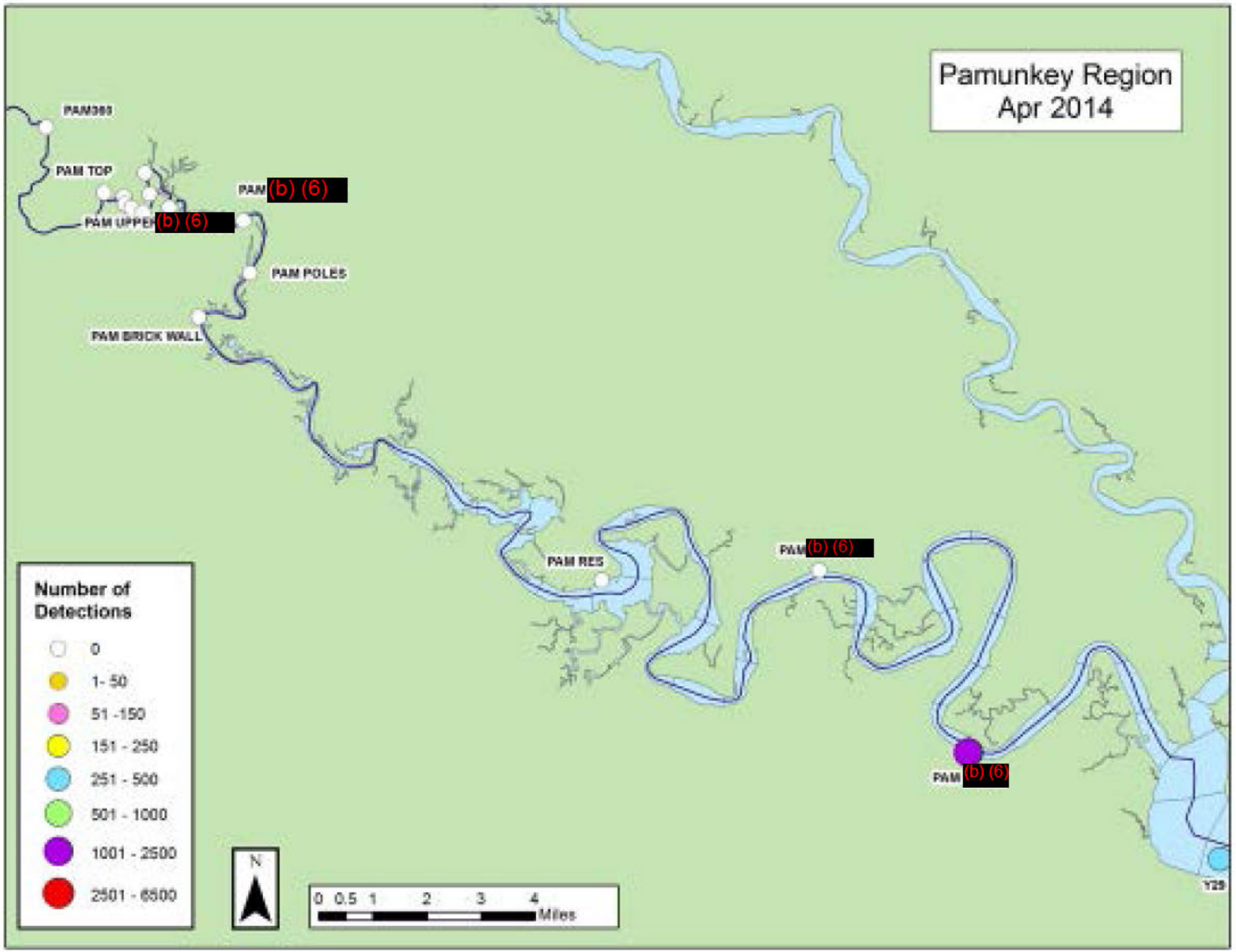


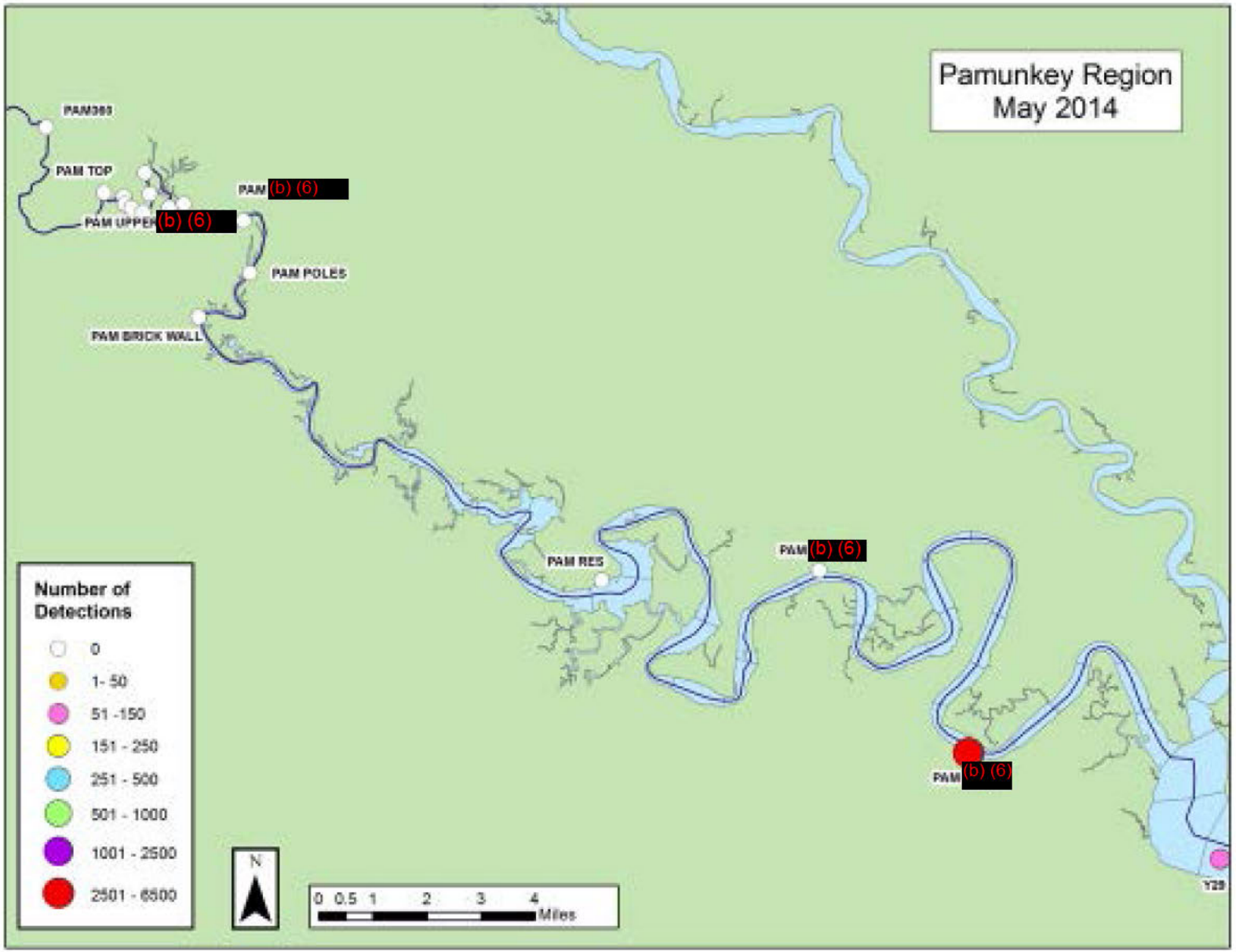

Pamunkey Region
Sep 2013
PAM360
PAM (b) (6)
PAM UPPER (b) (6)
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

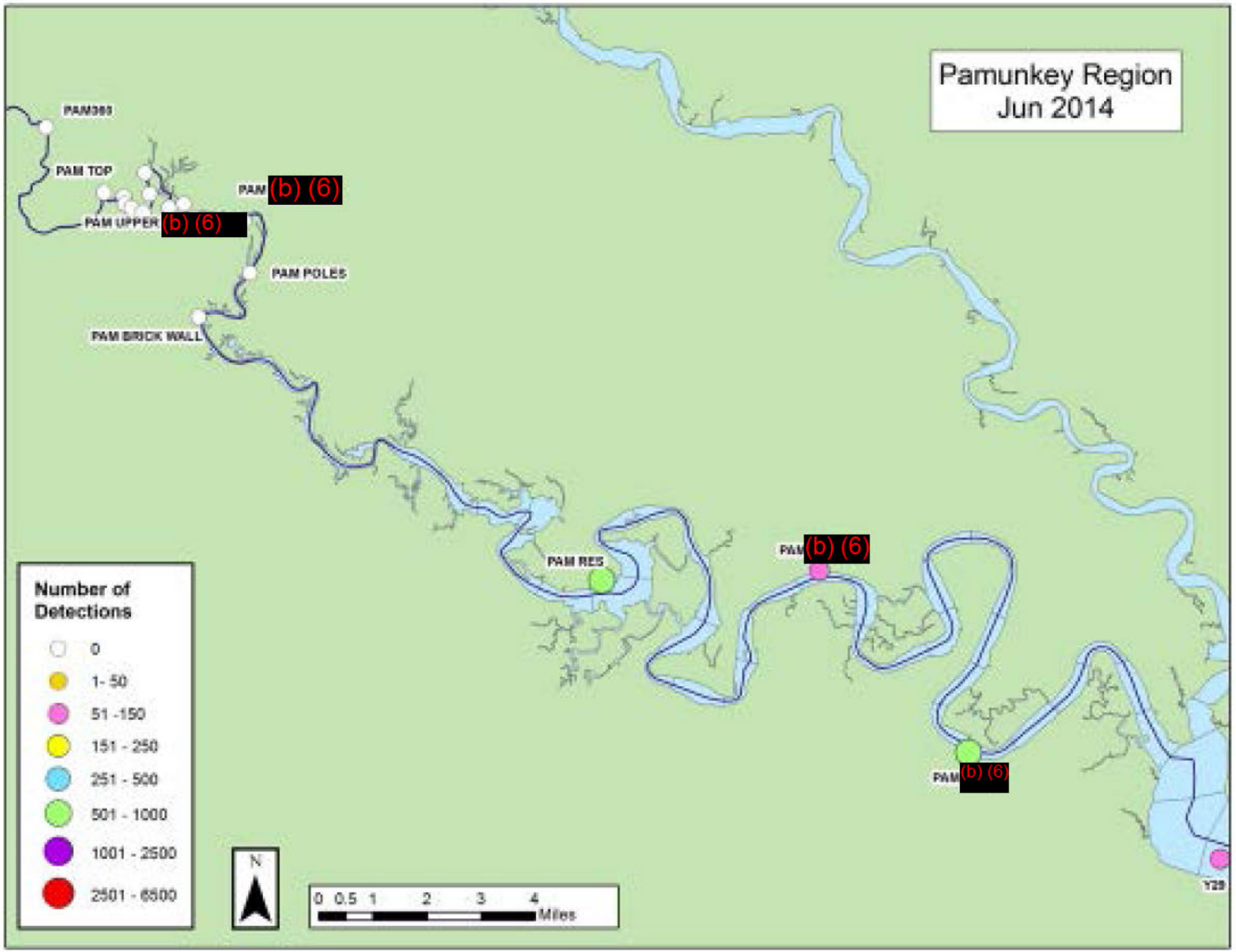

Pamunkey Region
Oct 2013
PAM360
PAM (b) (6)
PAM UPPER (b) (6)
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

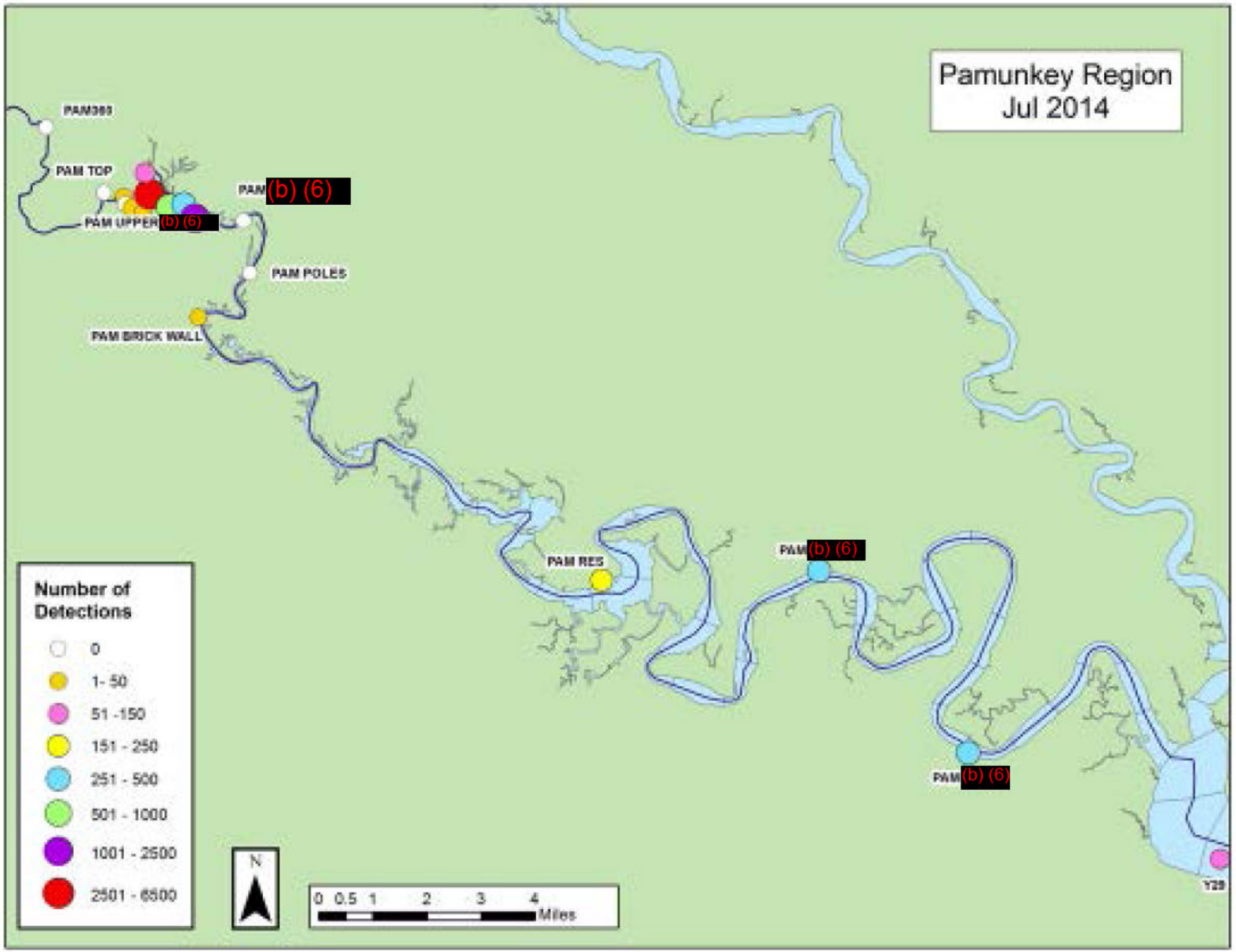

Pamunkey Region
Nov 2013
PAM360
PAM (b) (6)
PAM UPPER (b) (6)
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

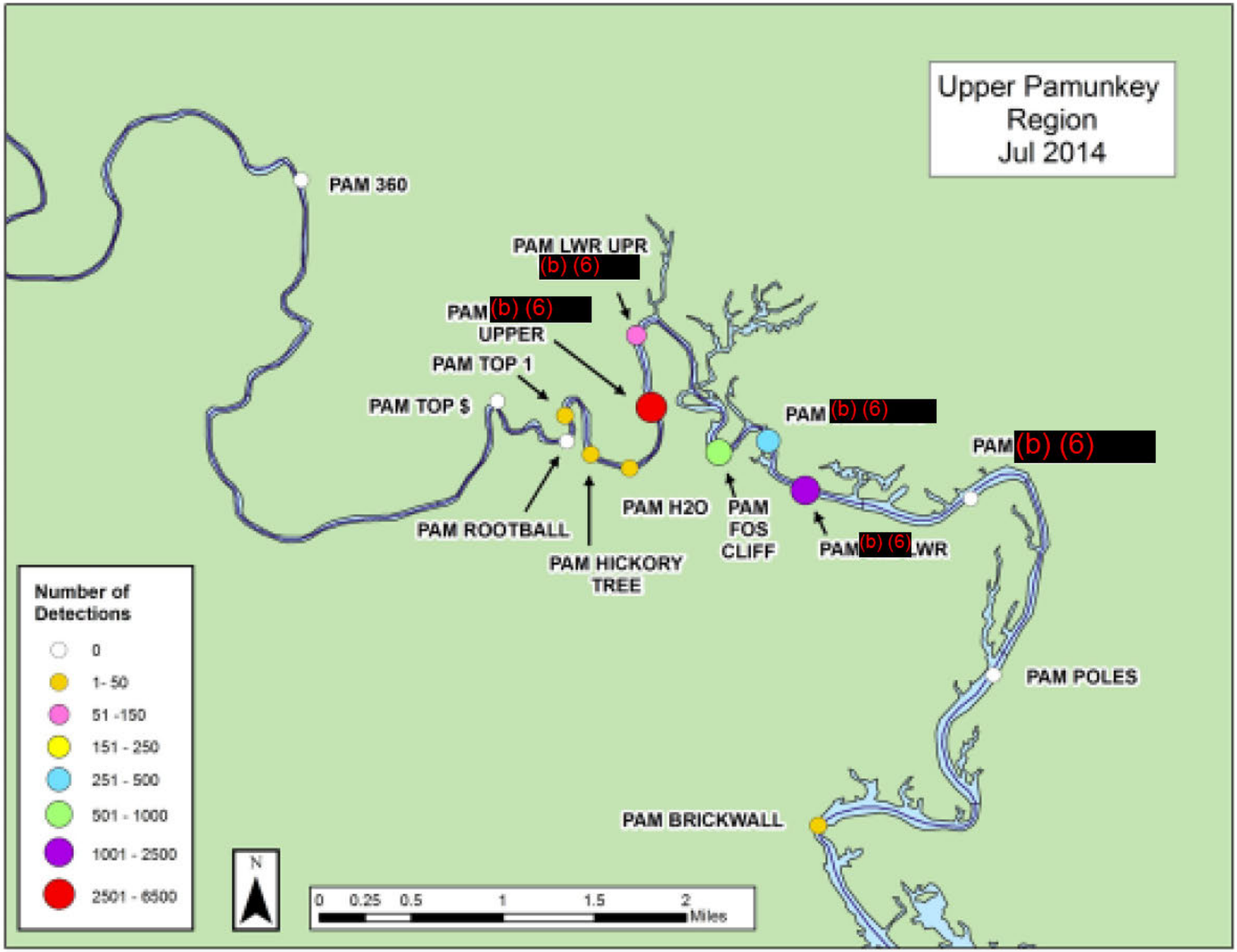

Pamunkey Region
Total 2013
PAM393
PAM
(b) (6)
PAM UPPER
(b) (6)
PAM BRICK WALL
PAM RES
PAM
(b) (6)
PAM
(b) (6)
Y29
Number of Detections
0
1 - 250
251 - 500
501 - 1000
1001 - 1500
1501 - 3500
3501 - 5000
5001 - 9500
N
0 0.5 1 2 3 4
Miles

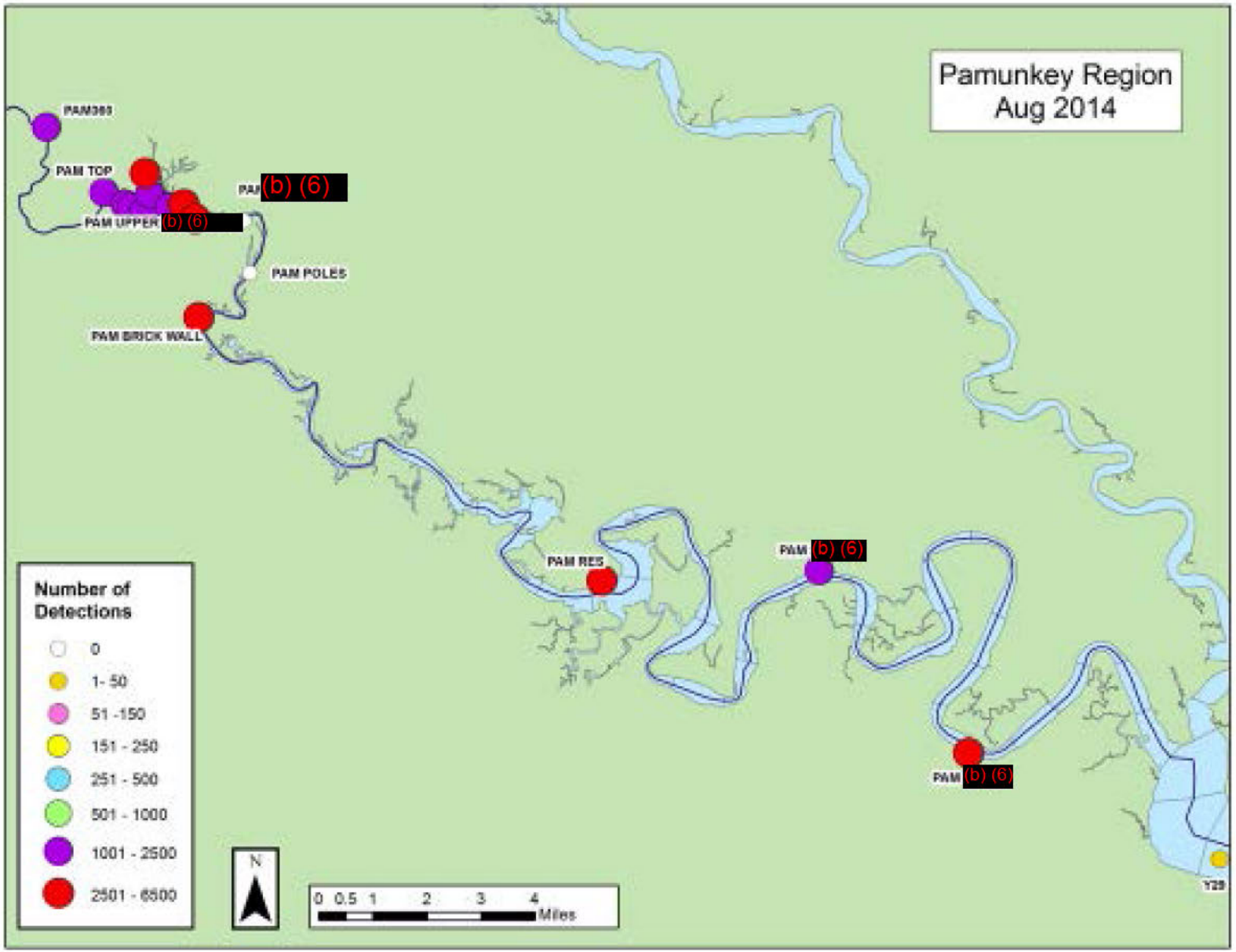

Pamunkey Region
Apr 2014
PAM393
PAM TOP
PAM (b) (6)
PAM UPPER (b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

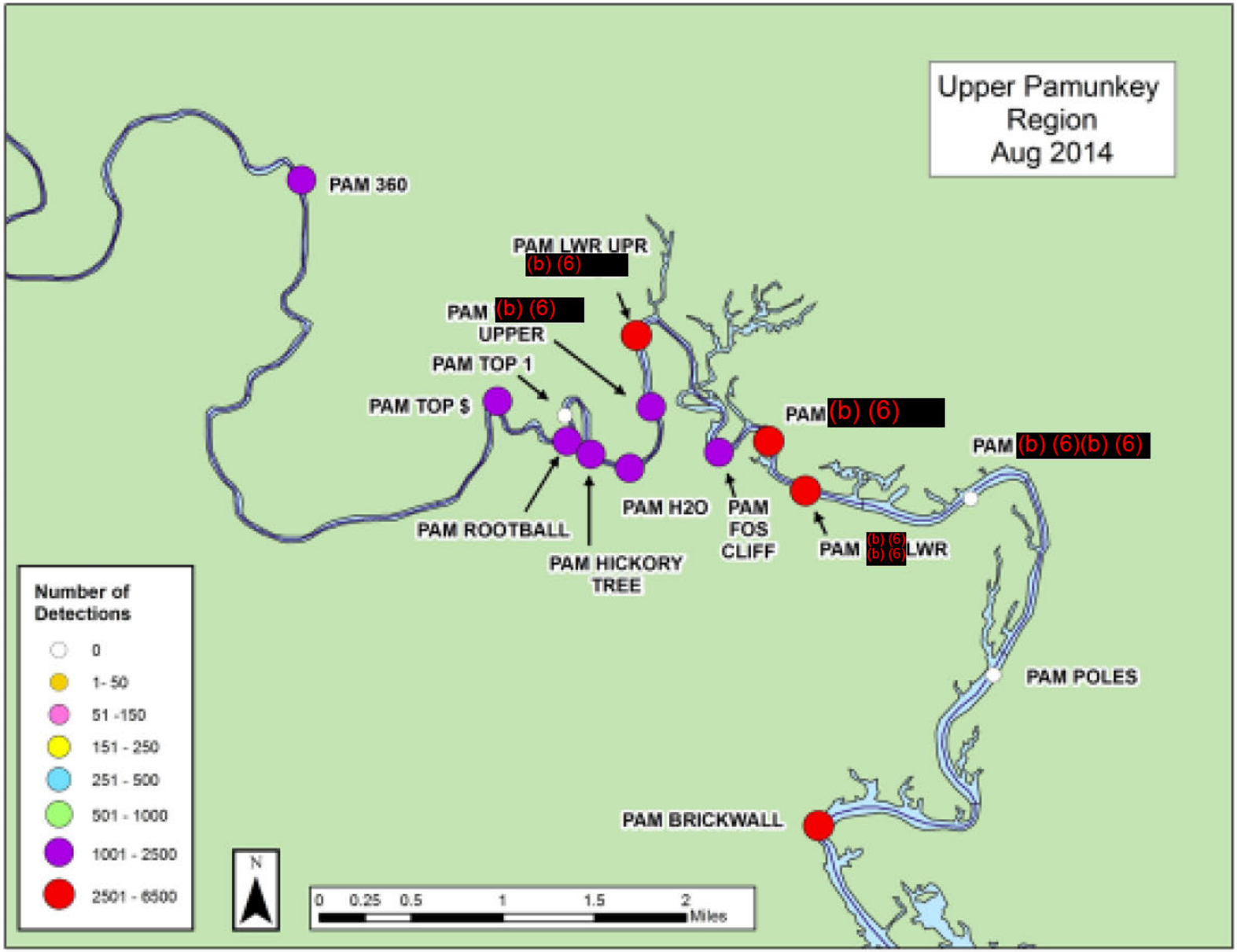

Pamunkey Region
May 2014
PAM380
PAM TOP
PAM (b) (6)
PAM UPPER (b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

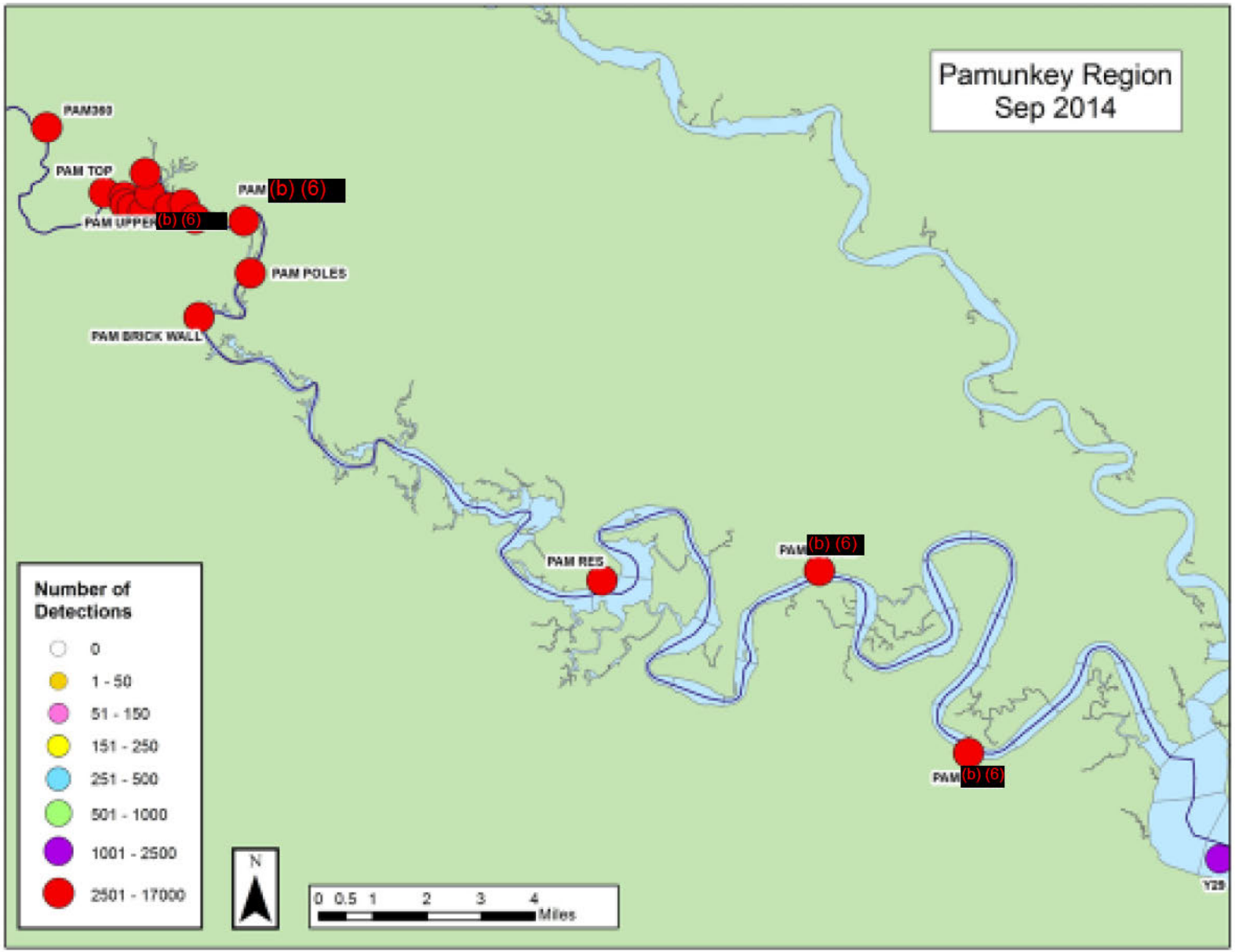

Pamunkey Region
Jun 2014
PAM380
PAM TOP
PAM (b) (6)
PAM UPPER (b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

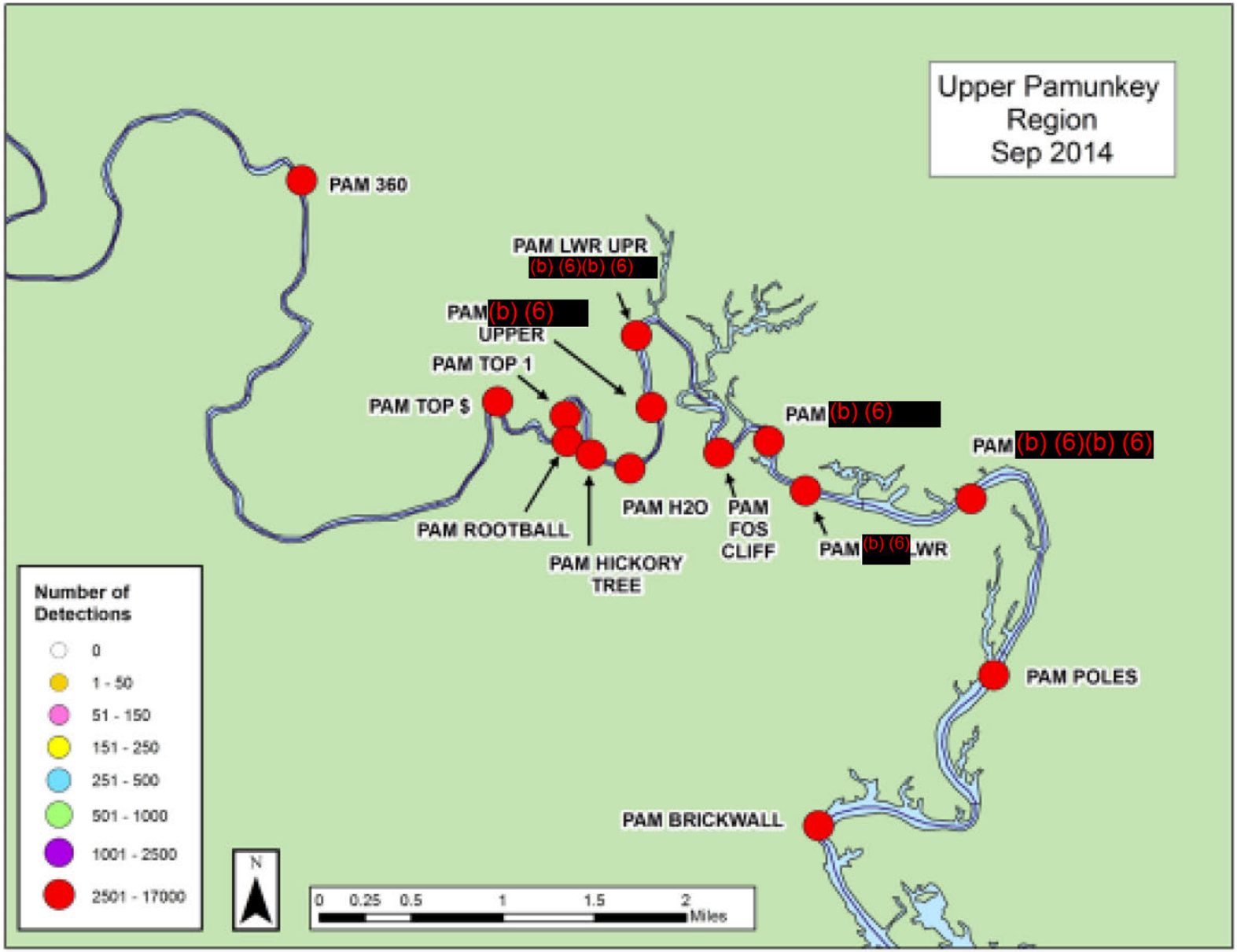

Pamunkey Region
Jul 2014
PAM380
PAM TOP
PAM (b) (6)
PAM UPPER (b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

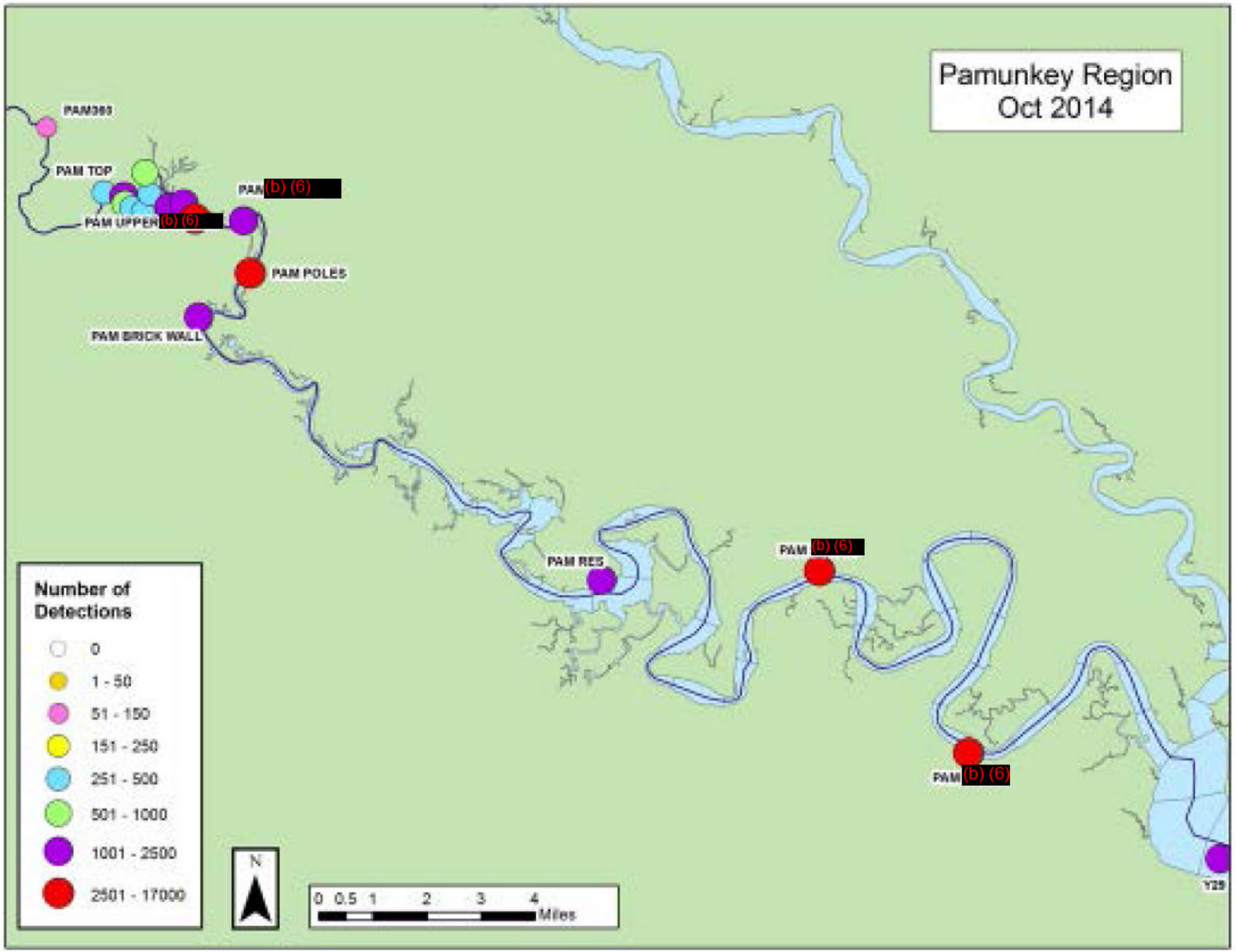

Upper Pamunkey Region Jul 2014
PAM 360
PAM LWR UPR (b) (6)
PAM (b) (6) UPPER
PAM TOP 1
PAM TOP $
PAM (b) (6)
PAM (b) (6)
PAM ROOTBALL
PAM HICKORY TREE
PAM H2O
PAM FOS CLIFF
PAM (b) (6) LWR
PAM POLES
PAM BRICKWALL
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5 2 Miles

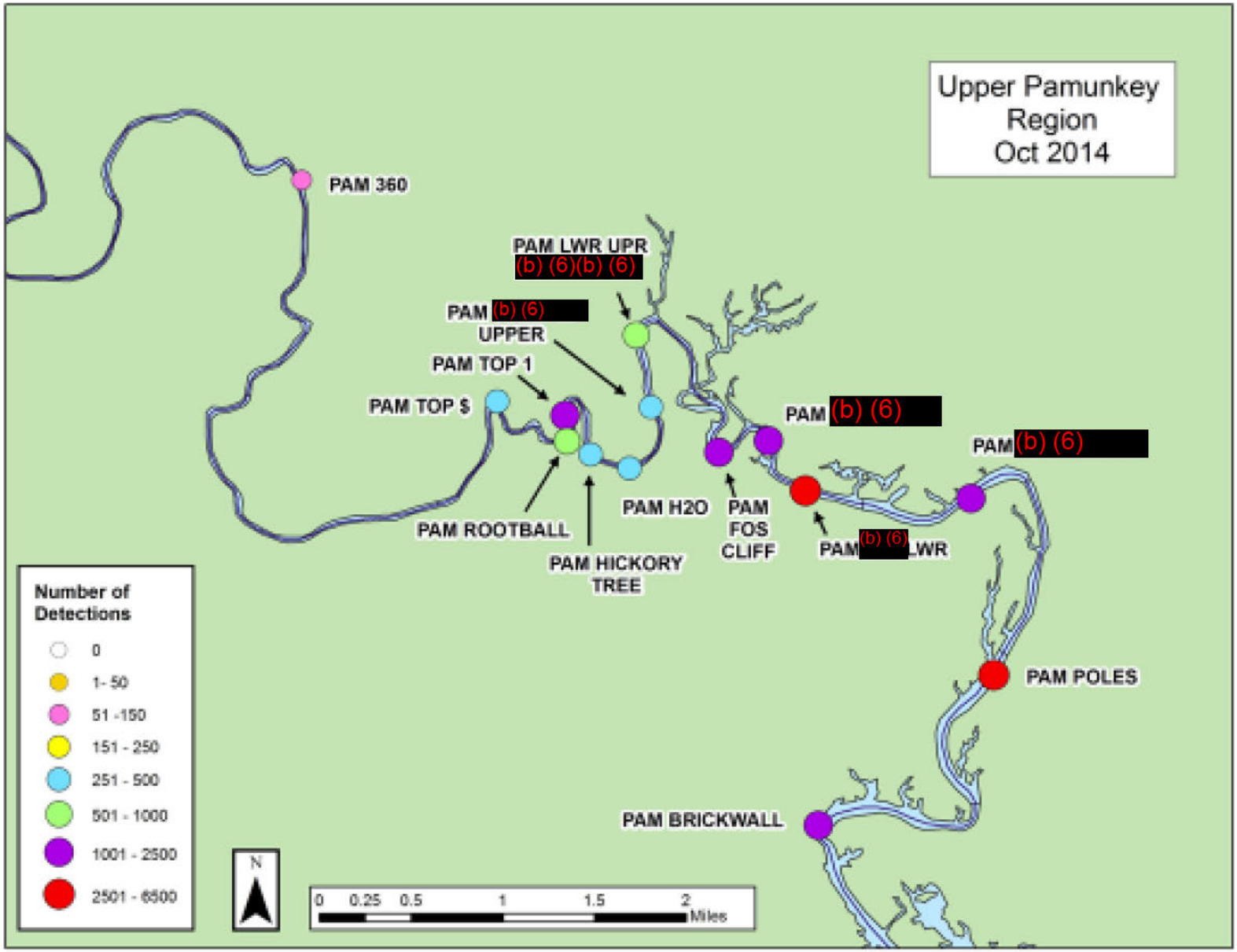

Pamunkey Region
Aug 2014
PAM380
PAM TOP
PAM (b) (6)
PAM UPPER (b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

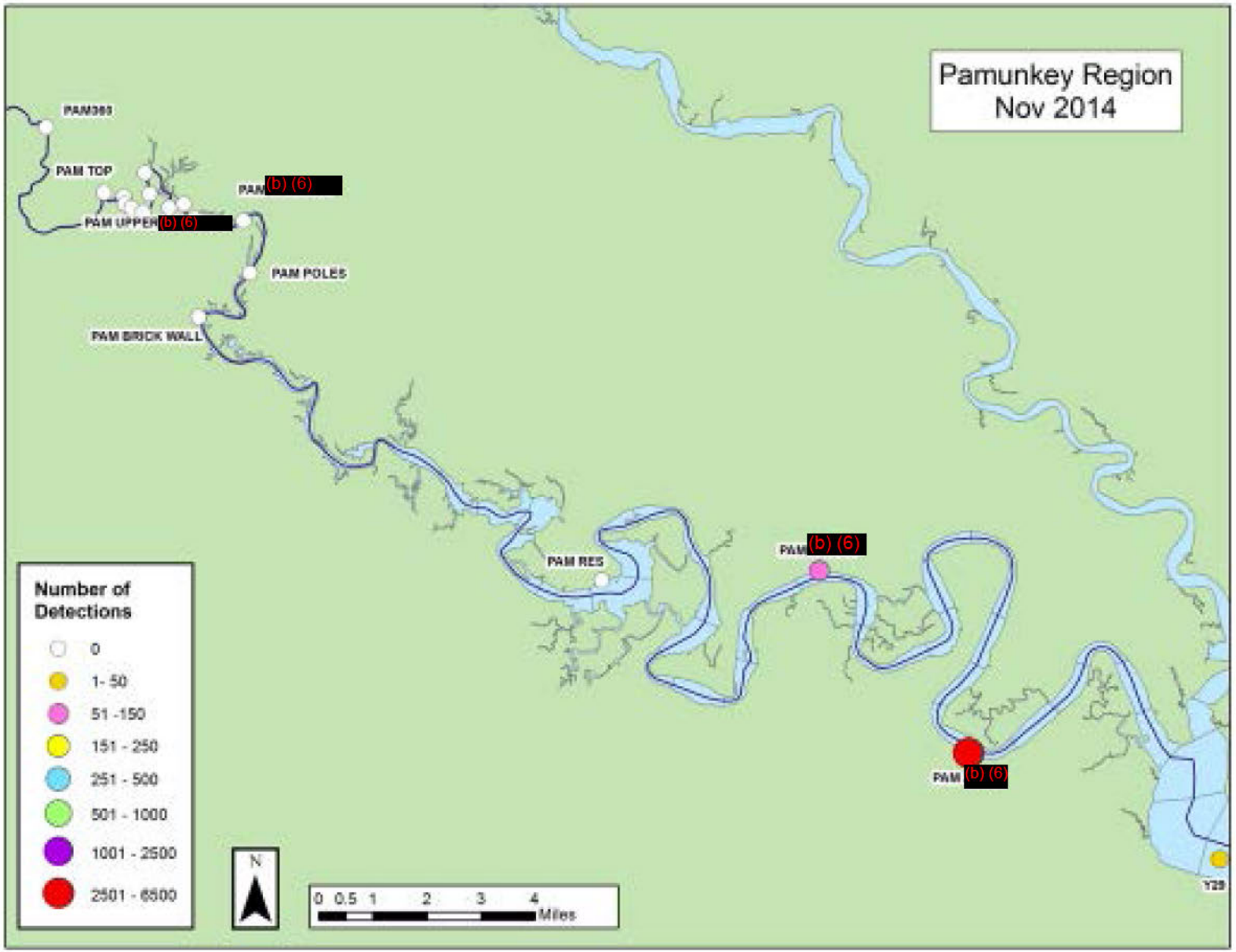

Upper Pamunkey Region Aug 2014
PAM 360
PAM LWR UPR (b) (6)
PAM (b) (6) UPPER
PAM TOP 1
PAM TOP $
PAM (b) (6)
PAM (b) (6)(b) (6)
PAM ROOTBALL
PAM HICKORY TREE
PAM H2O
PAM FOS CLIFF
PAM (b) (6) (b) (6) LWR
PAM POLES
PAM BRICKWALL
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5 2 Miles

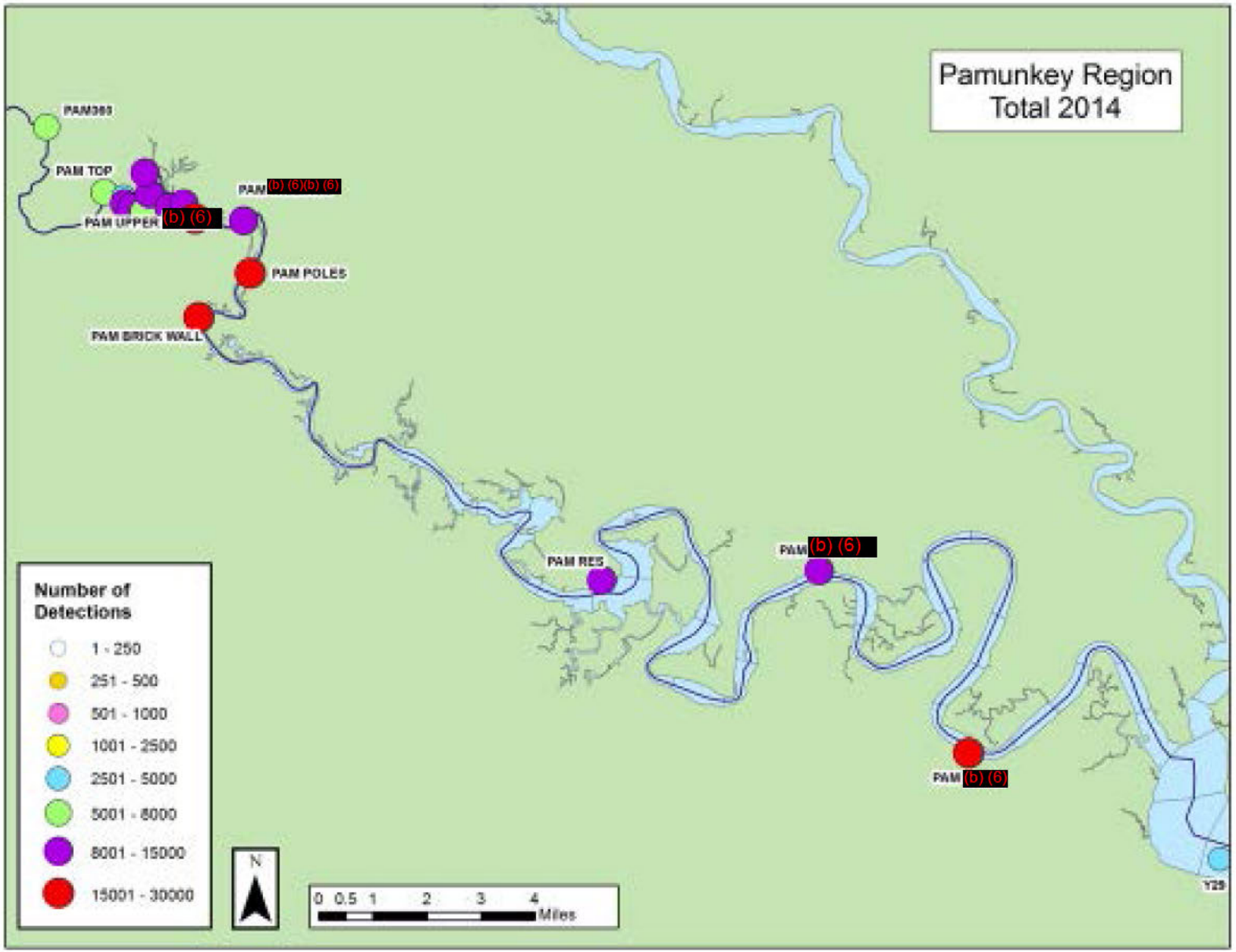

Pamunkey Region
Sep 2014
PAM380
PAM TOP
PAM (b) (6)
PAM UPPER (b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 17000
N
0 0.5 1 2 3 4
Miles

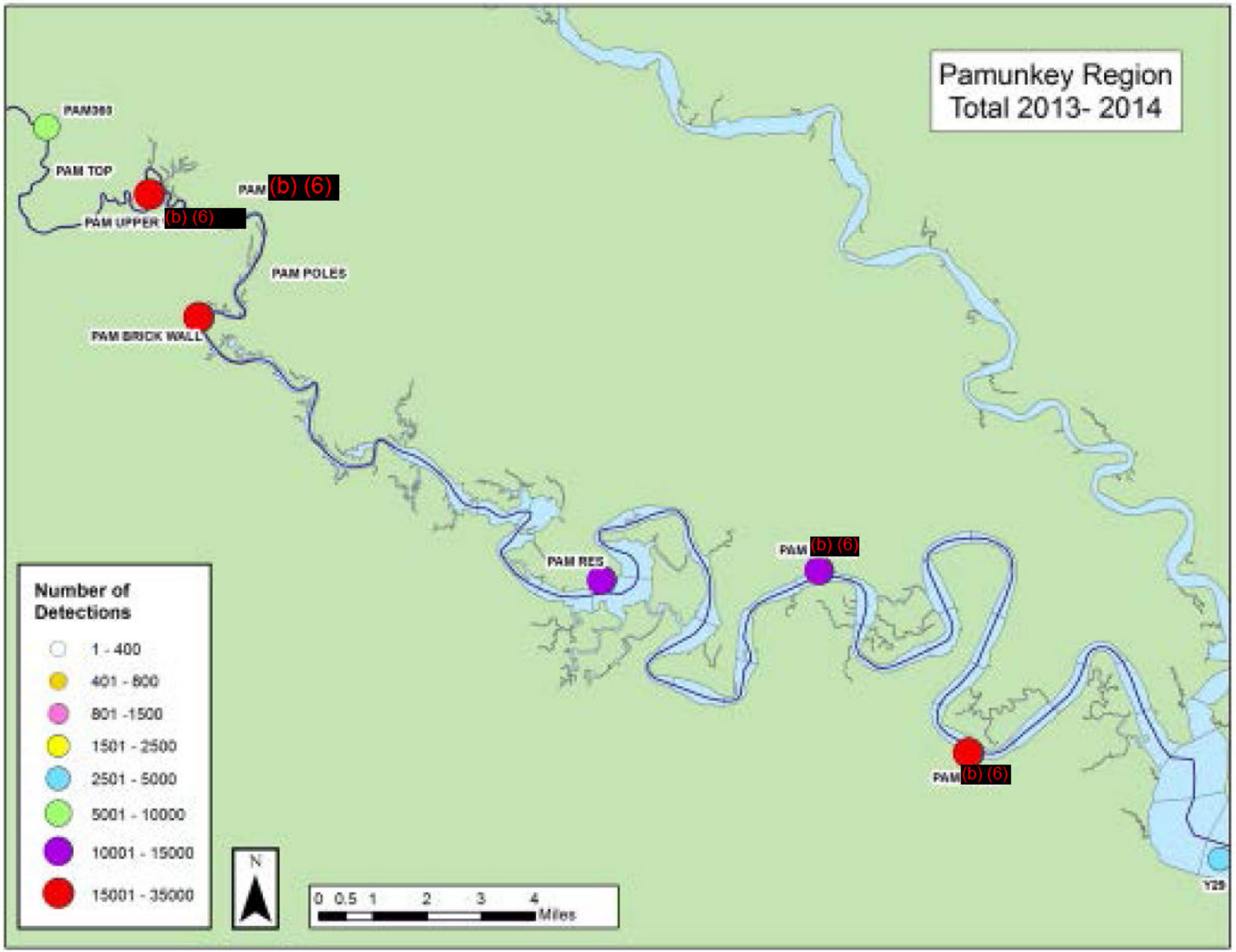

Upper Pamunkey Region Sep 2014
PAM 360
PAM LWR UPR
(b) (6)(b) (6)
PAM (b) (6) UPPER
PAM TOP 1
PAM TOP $
PAM (b) (6)
PAM (b) (6)(b) (6)
PAM H2O
PAM FOS CLIFF
PAM (b) (6) LWR
PAM ROOTBALL
PAM HICKORY TREE
PAM POLES
PAM BRICKWALL
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 17000
N
0 0.25 0.5 1 1.5 2
Miles


Pamunkey Region
Oct 2014
PAM380
PAM TOP
PAM (b) (6)
PAM UPPER (b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 17000
N
0 0.5 1 2 3 4
Miles

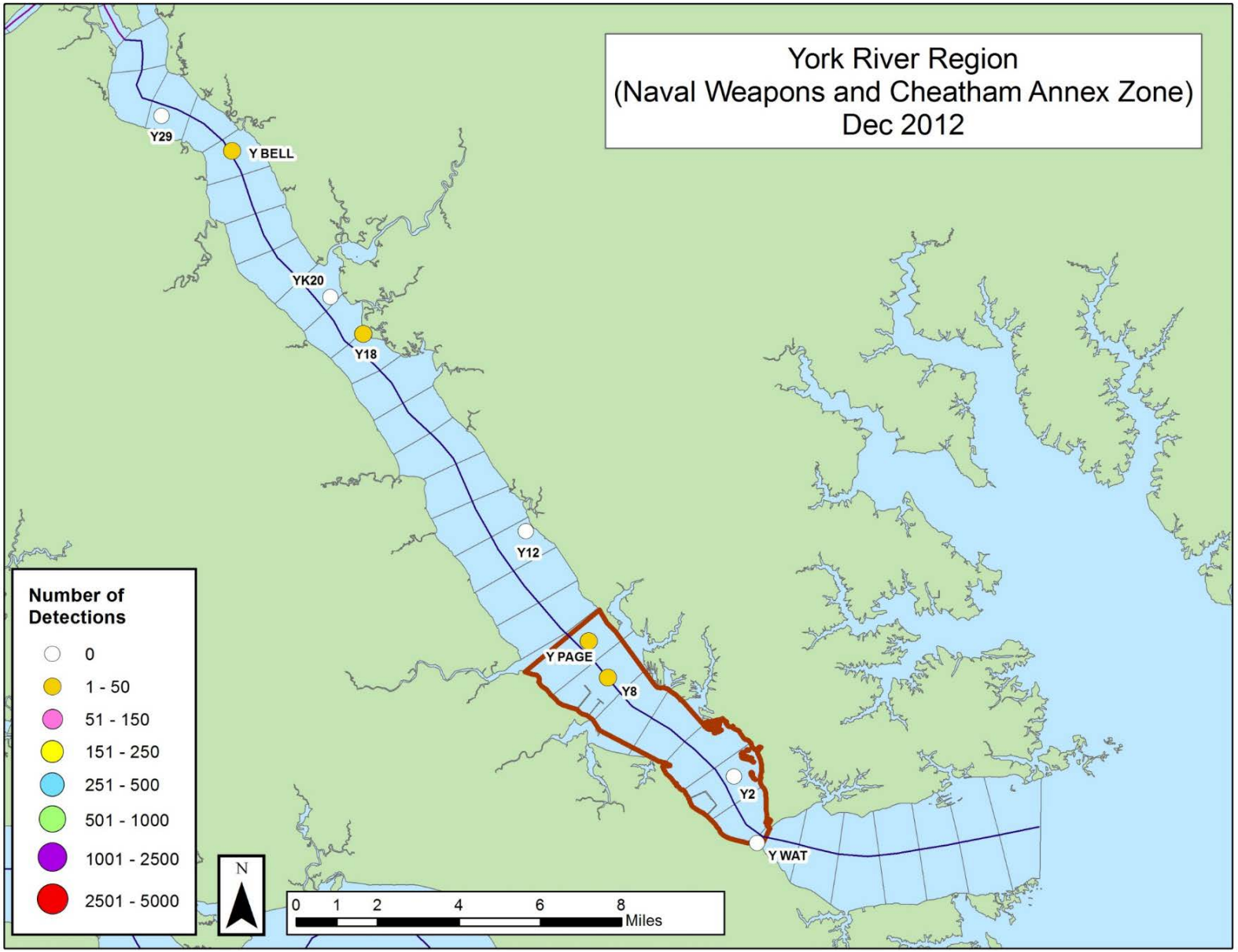

Upper Pamunkey Region Oct 2014
PAM 360
PAM LWR UPR (b) (6)(b) (6)
PAM (b) (6) UPPER
PAM TOP 1
PAM TOP $
PAM (b) (6)
PAM (b) (6)
PAM ROOTBALL
PAM HICKORY TREE
PAM H2O
PAM FOS CLIFF
PAM (b) (6) LWR
PAM POLES
PAM BRICKWALL
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5 2 Miles

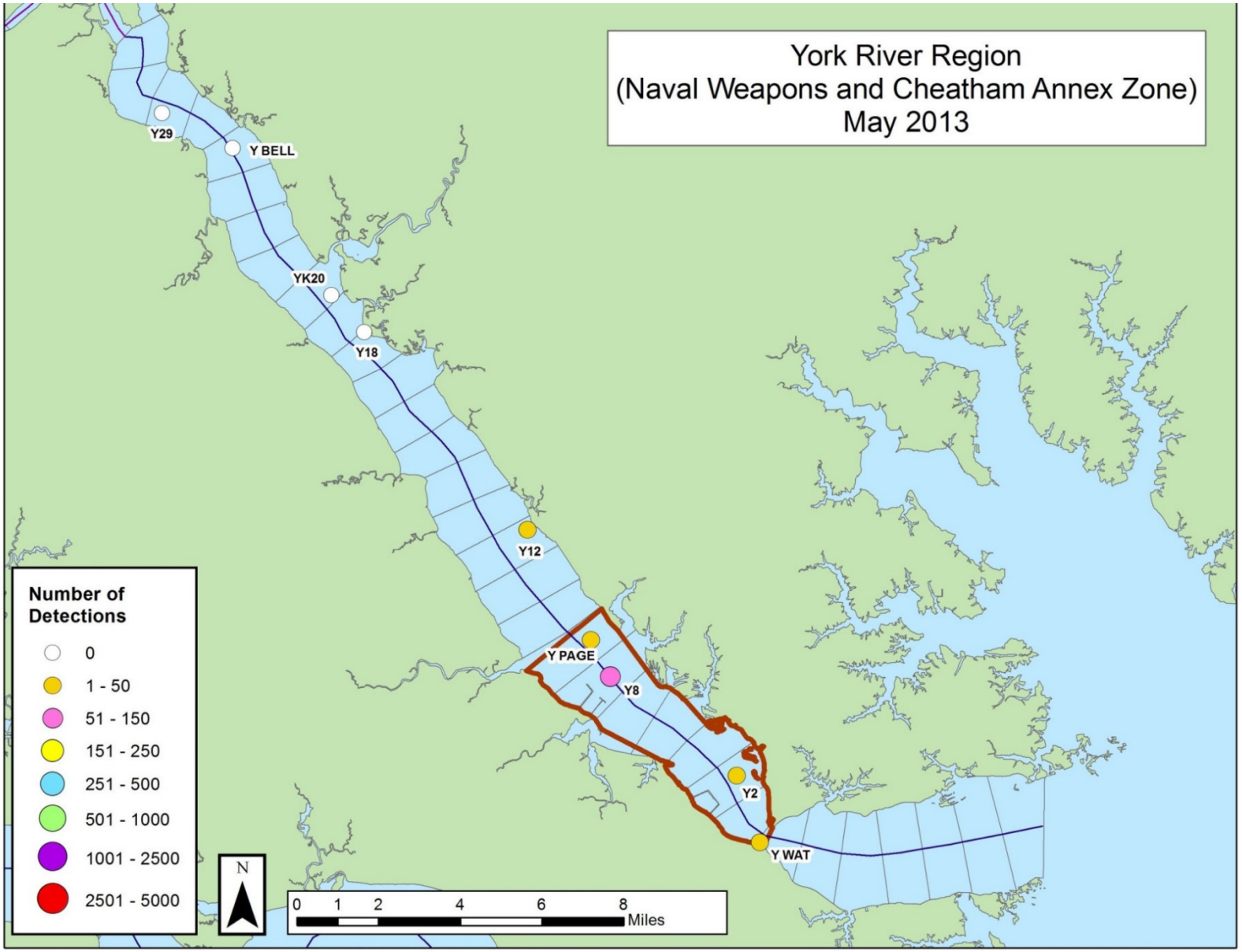

Pamunkey Region
Nov 2014
PAM380
PAM TOP
PAM (b) (6)
PAM UPPER (b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

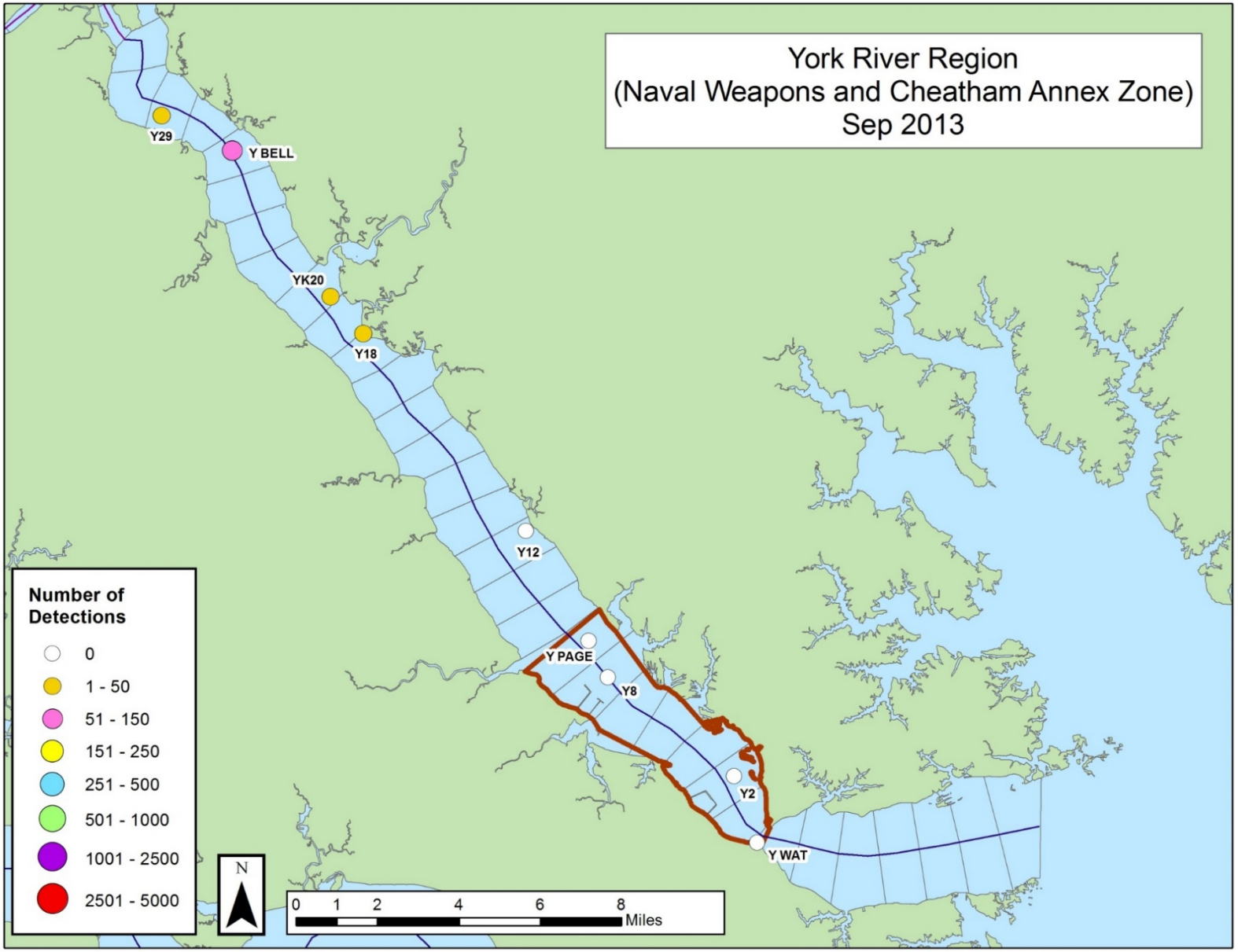

Pamunkey Region
Total 2014
PAM380
PAM TOP
PAM UPPER
PAM (b) (6)(b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
1 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
5001 - 8000
8001 - 15000
15001 - 30000
N
0 0.5 1 2 3 4
Miles

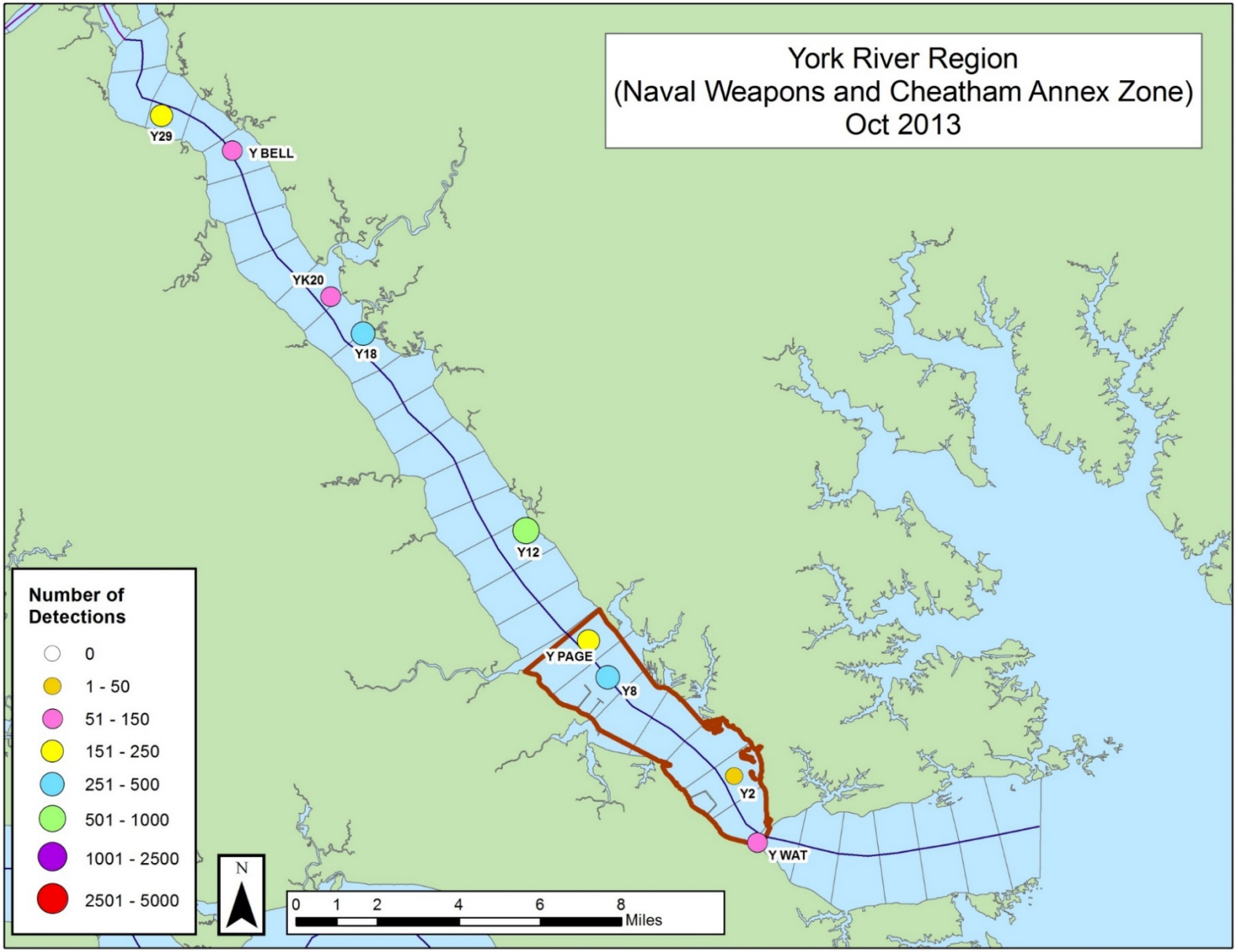

Pamunkey Region
Total 2013- 2014
PAM380
PAM TOP
PAM (b) (6)
PAM UPPER (b) (6)
PAM POLES
PAM BRICK WALL
PAM RES
PAM (b) (6)
PAM (b) (6)
Y29
Number of Detections
1 - 400
401 - 800
801 -1500
1501 - 2500
2501 - 5000
5001 - 10000
10001 - 15000
15001 - 35000
N
0 0.5 1 2 3 4
Miles

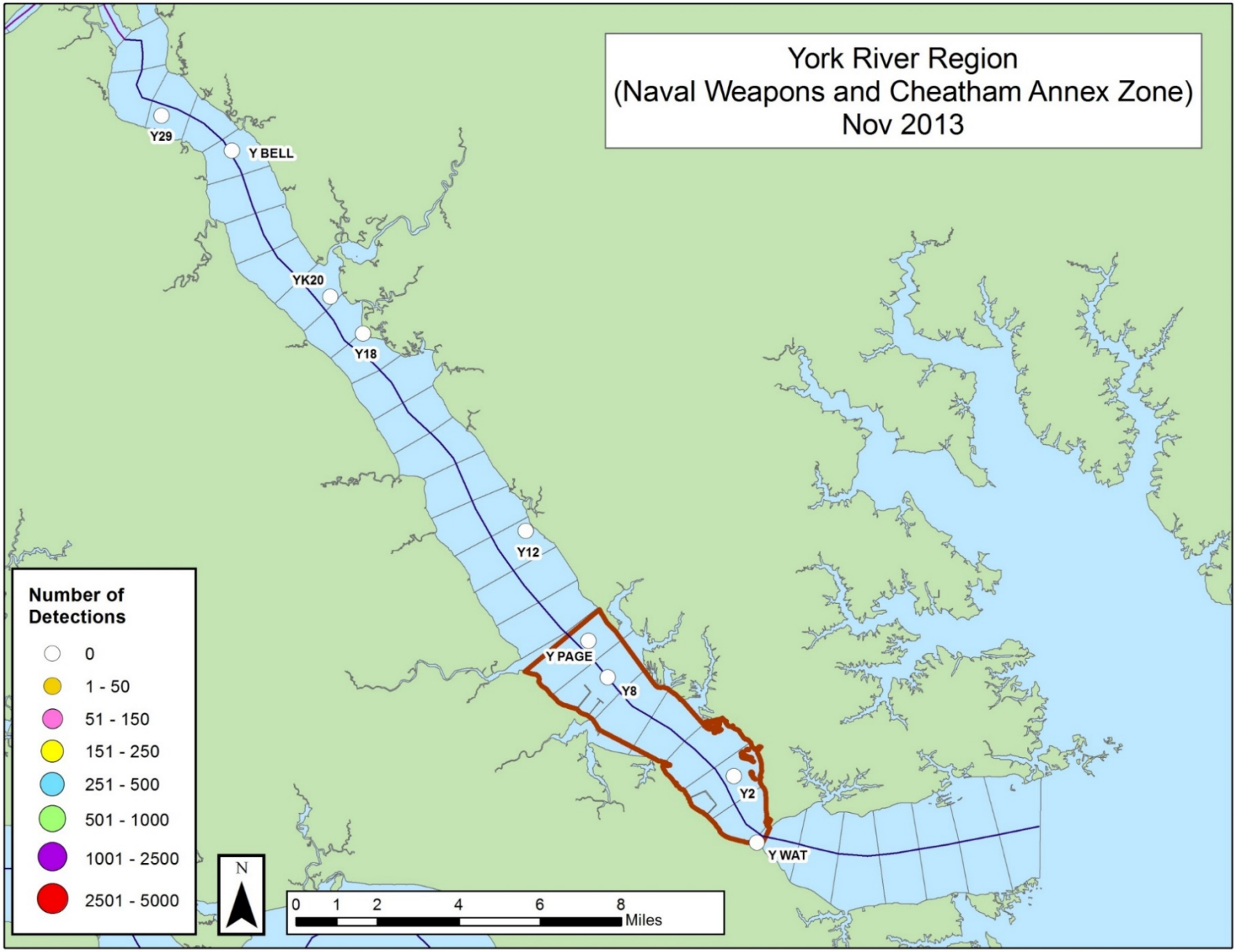
9.4 Appendix 4.4.2: York River Region (Naval Weapons Station Yorktown and Cheatham Annex Zone)

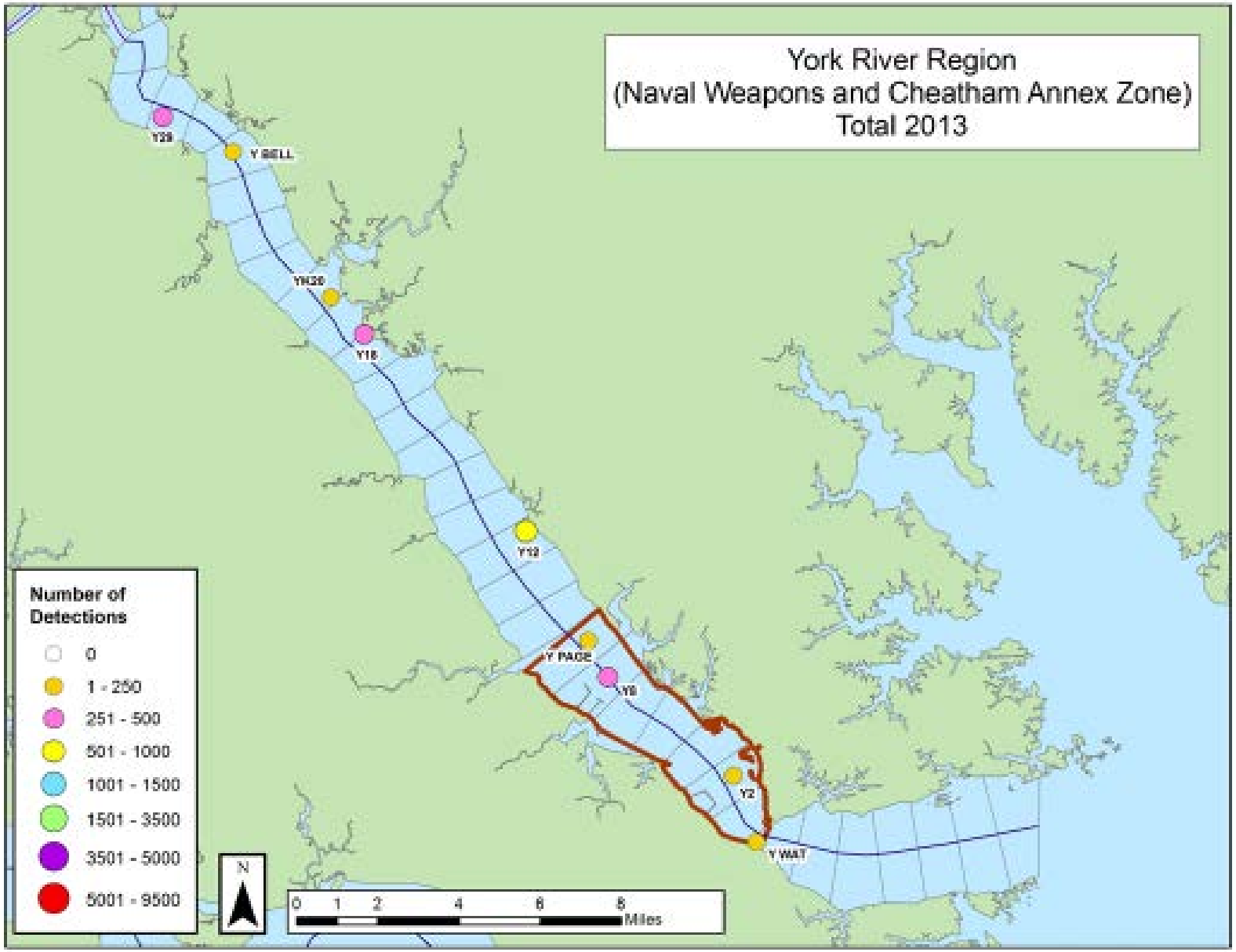


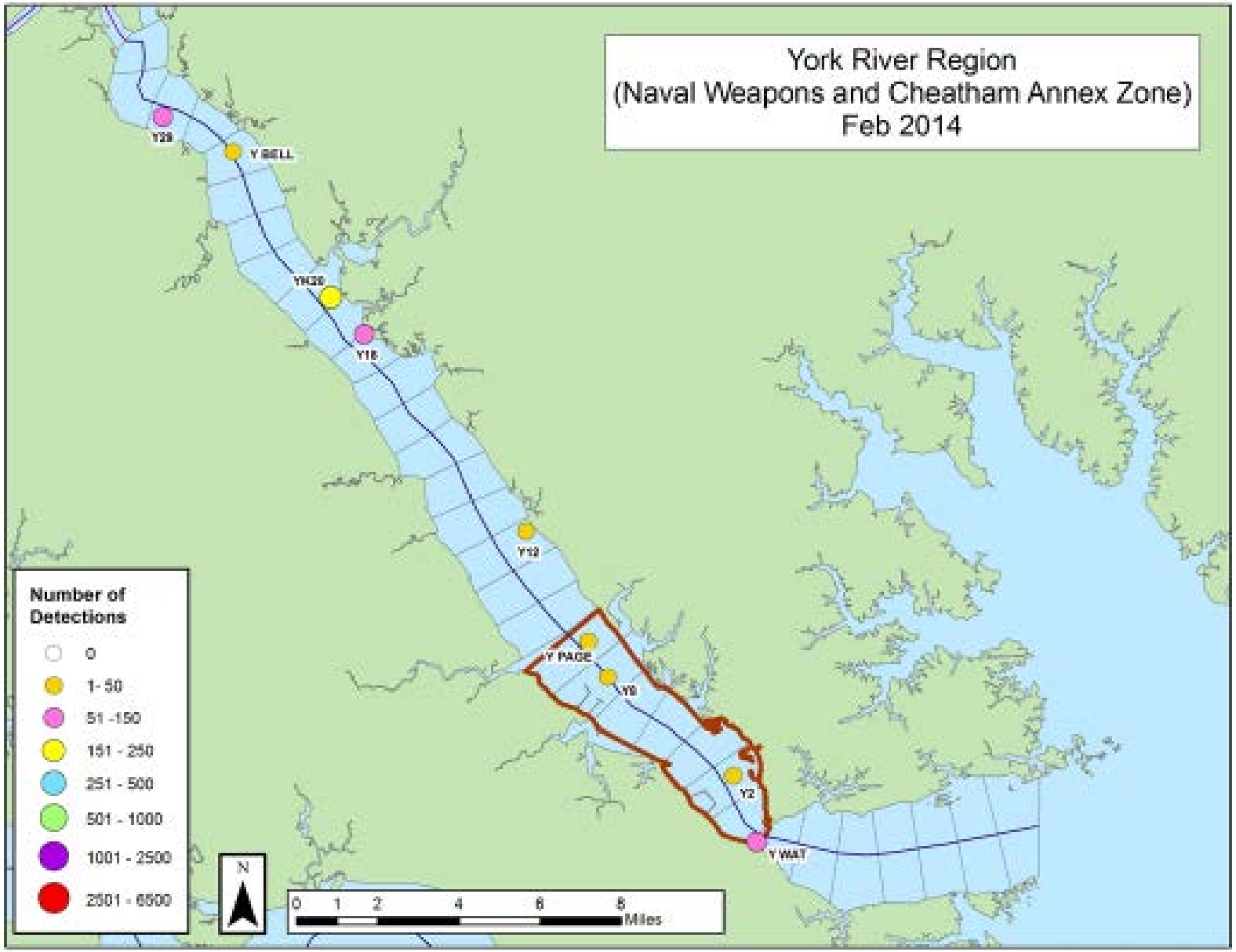

York River Region
(Naval Weapons and Cheatham Annex Zone)
May 2013
Y29
Y BELL
YK20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 1 2 4 6 8
Miles

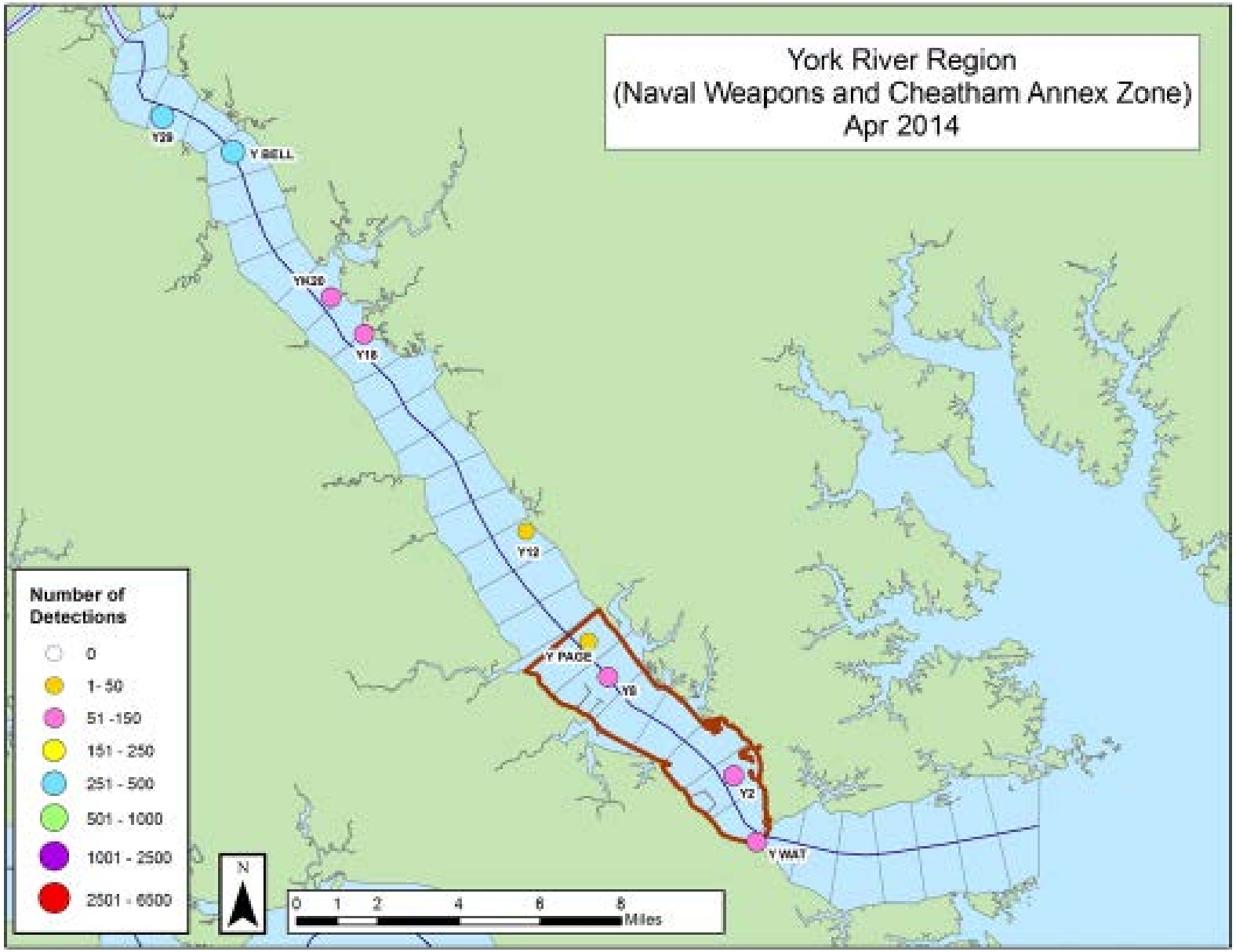

York River Region
(Naval Weapons and Cheatham Annex Zone)
Sep 2013
Y29
Y BELL
YK20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 1 2 4 6 8
Miles

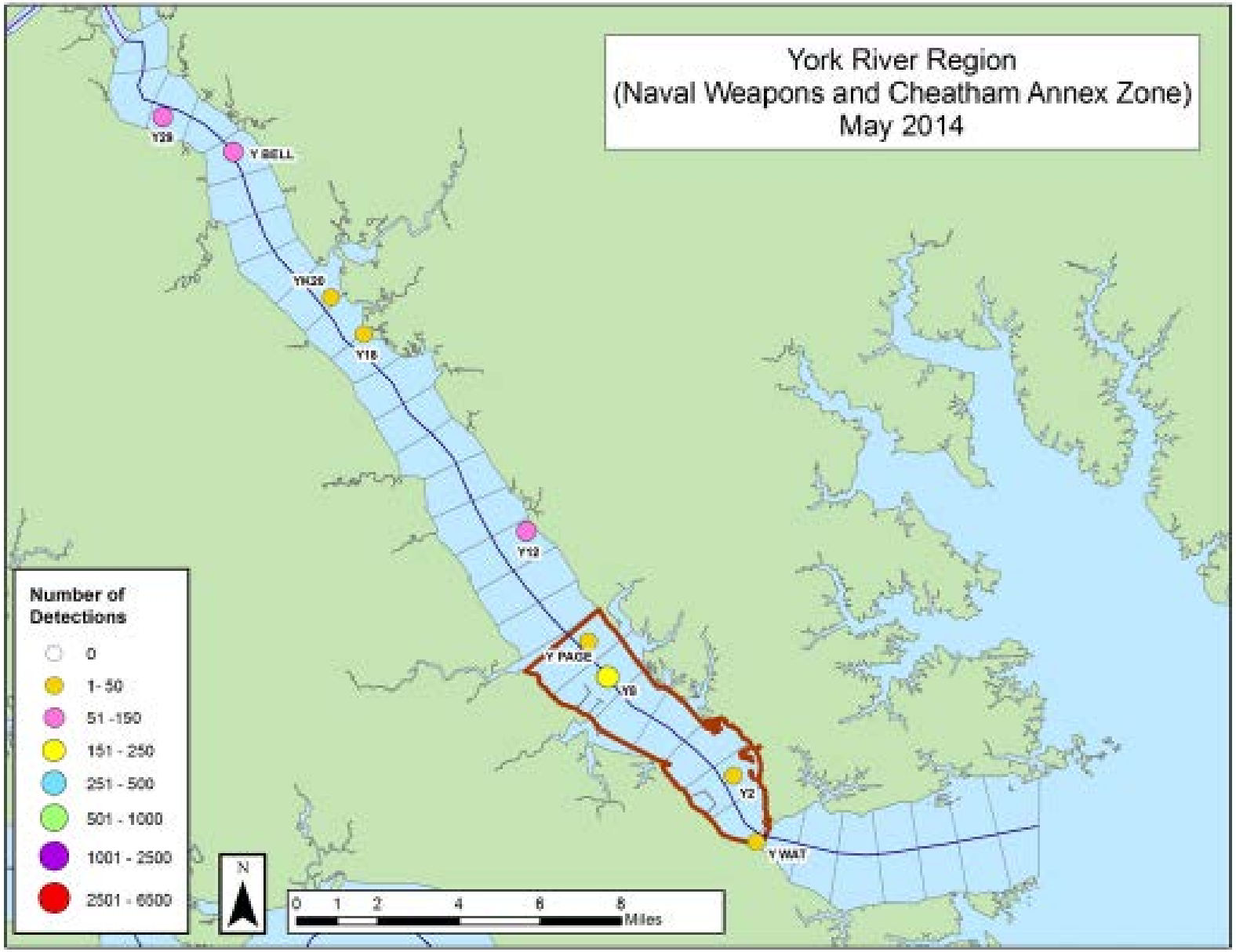

York River Region
(Naval Weapons and Cheatham Annex Zone)
Oct 2013
Y29
Y BELL
YK20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 1 2 4 6 8
Miles

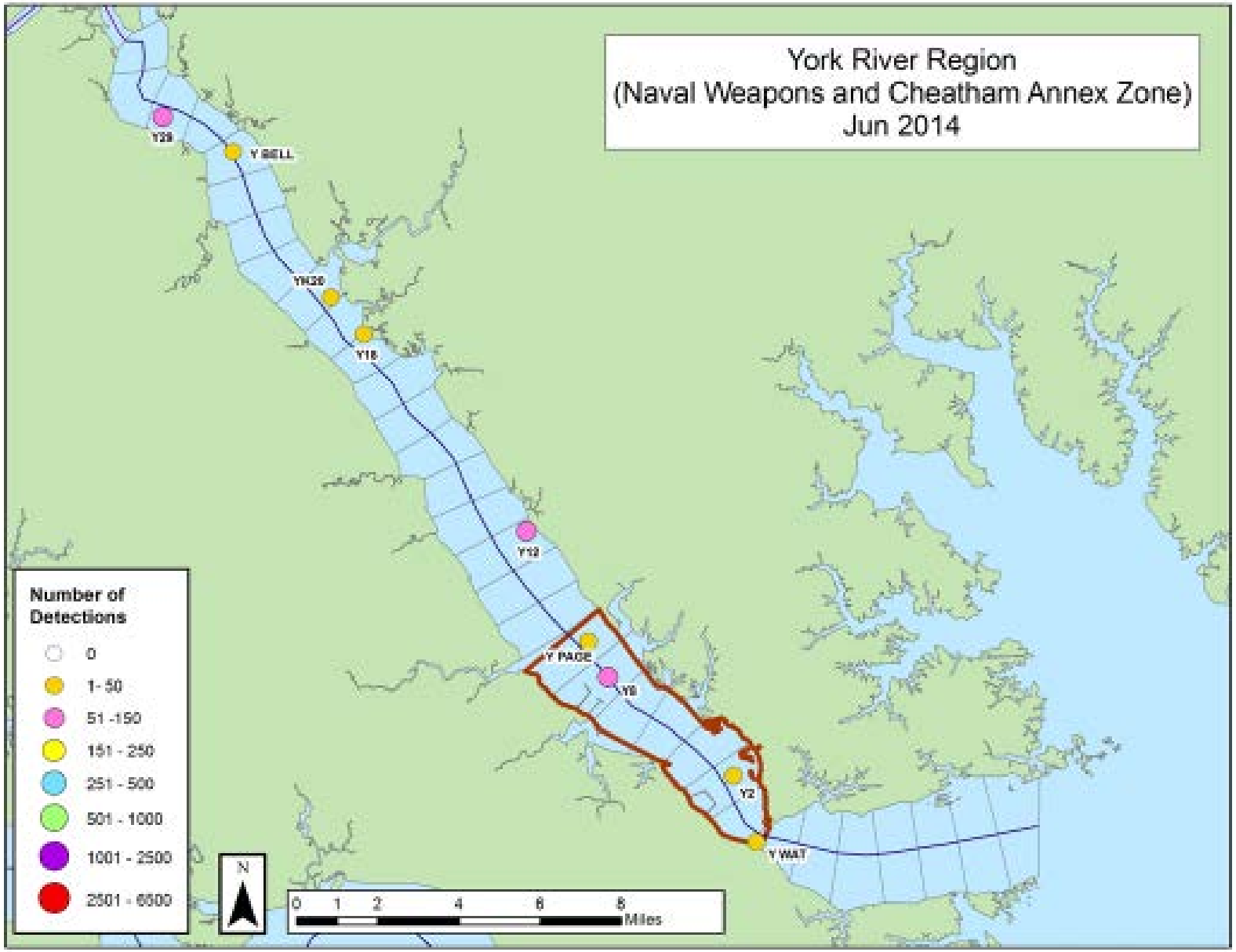

York River Region
(Naval Weapons and Cheatham Annex Zone)
Nov 2013
Y29
Y BELL
YK20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 1 2 4 6 8
Miles

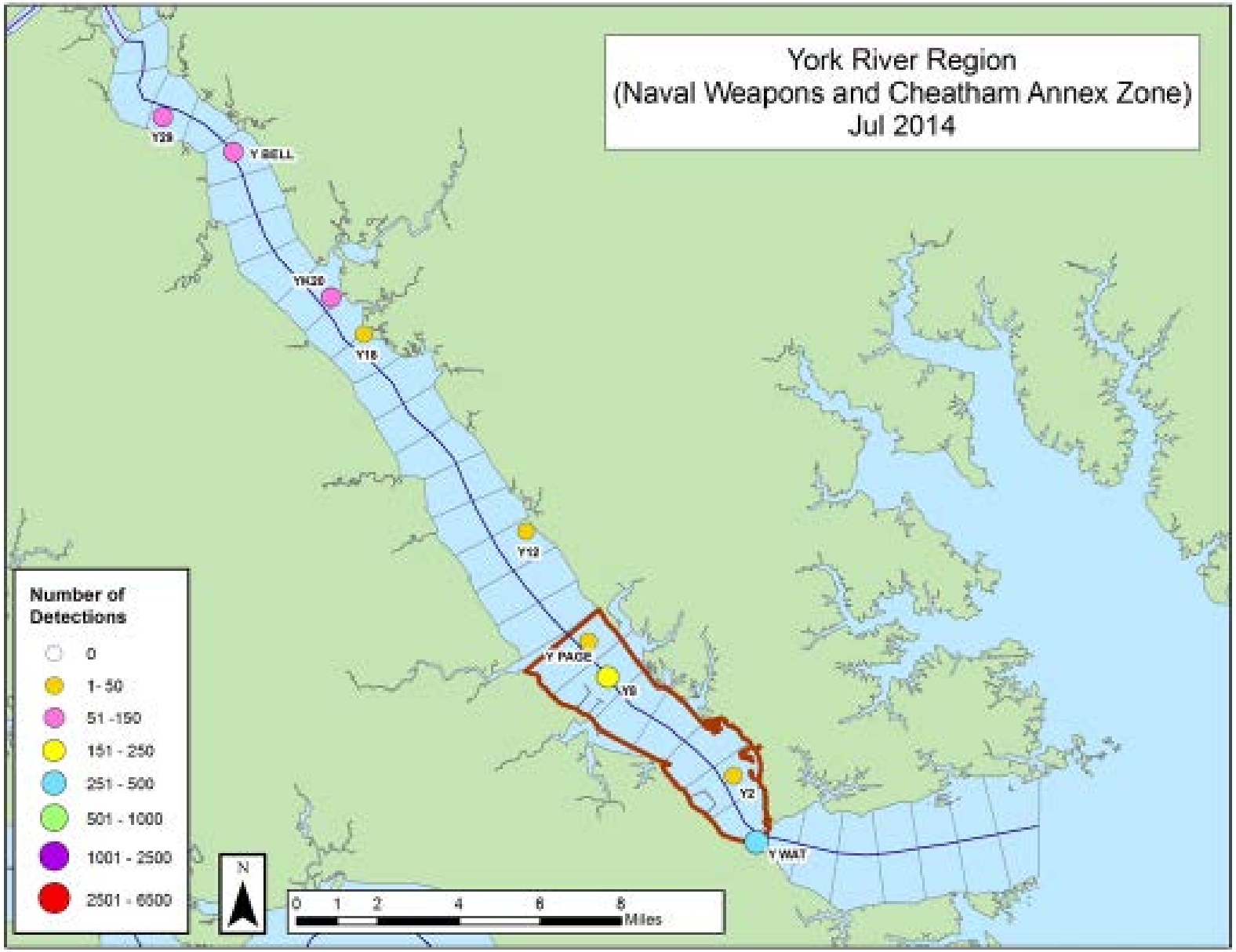

York River Region
(Naval Weapons and Cheatham Annex Zone)
Total 2013
Y BELL
Y12
Y PAGE
Y2
Y WAT
Number of Detections
0
1 - 250
251 - 500
501 - 1000
1001 - 1500
1501 - 3500
3501 - 5000
5001 - 9500
N
0 1 2 4 6 8 Miles

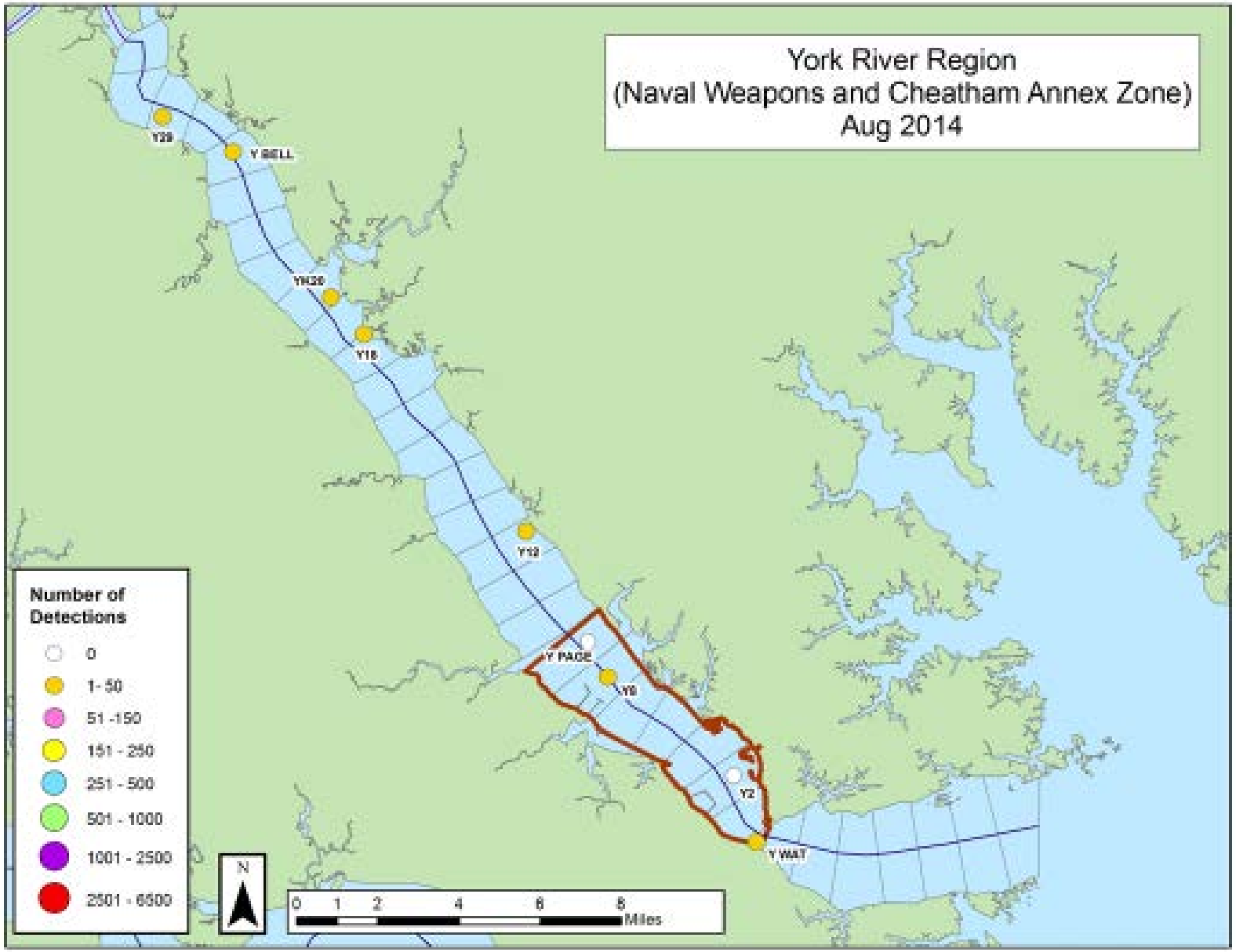

York River Region
(Naval Weapons and Cheatham Annex Zone)
Feb 2014
Y39
Y BELL
YN20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 1 2 4 6 8 Miles

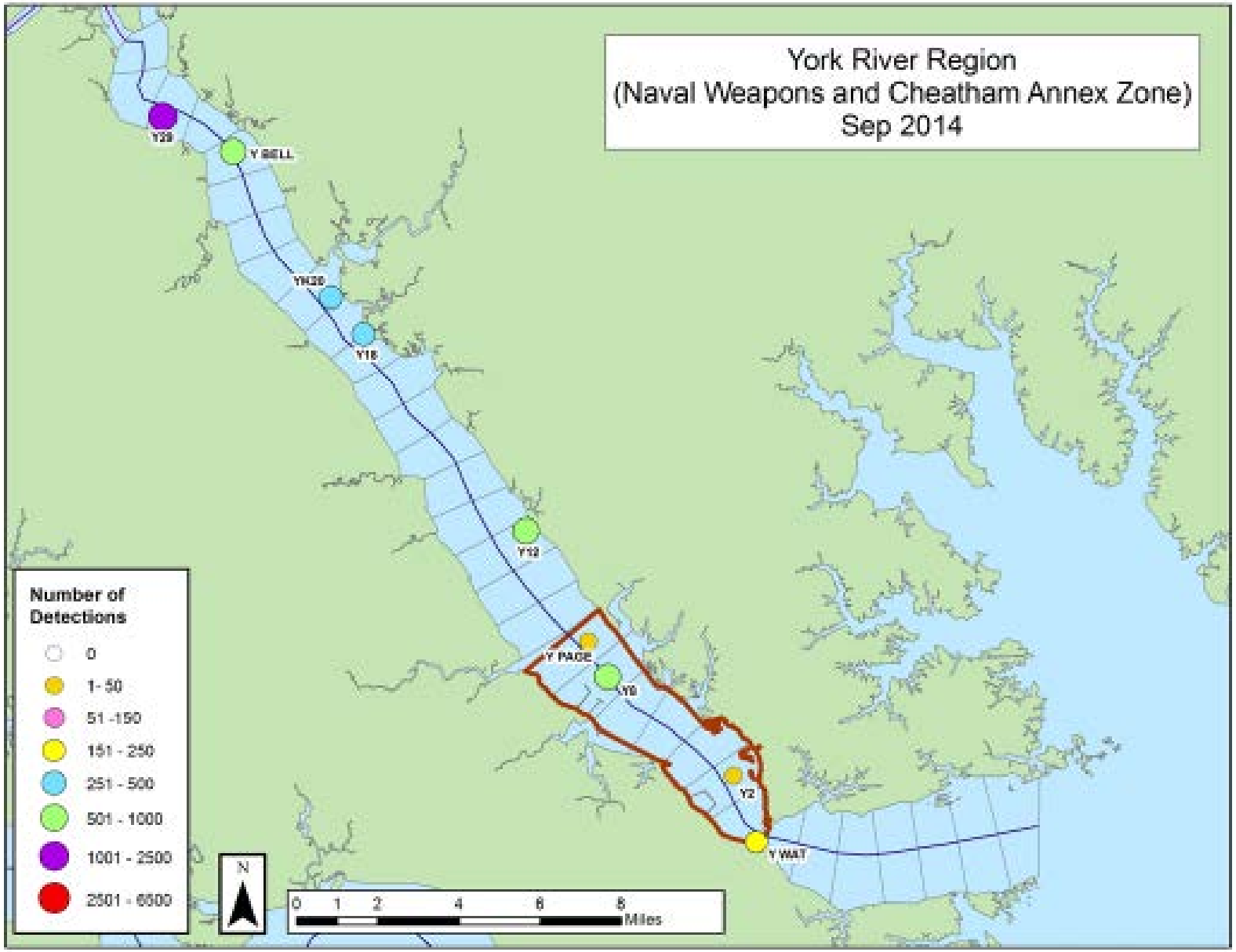

York River Region
(Naval Weapons and Cheatham Annex Zone)
Apr 2014
Y39
Y BELL
YN20
Y16
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 1 2 4 6 8 Miles

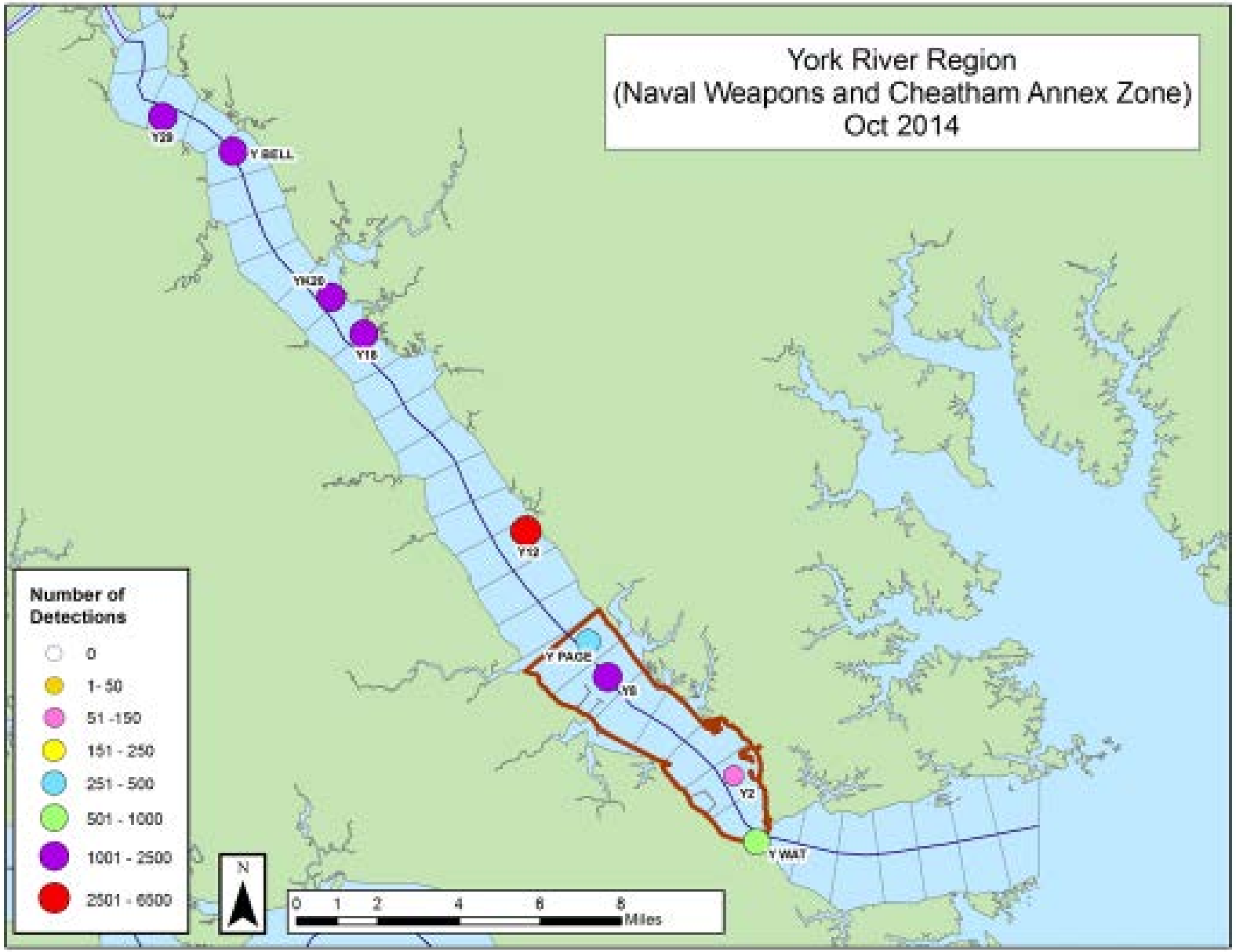

York River Region
(Naval Weapons and Cheatham Annex Zone)
May 2014
Y39
Y BELL
YN20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 1 2 4 6 8 Miles

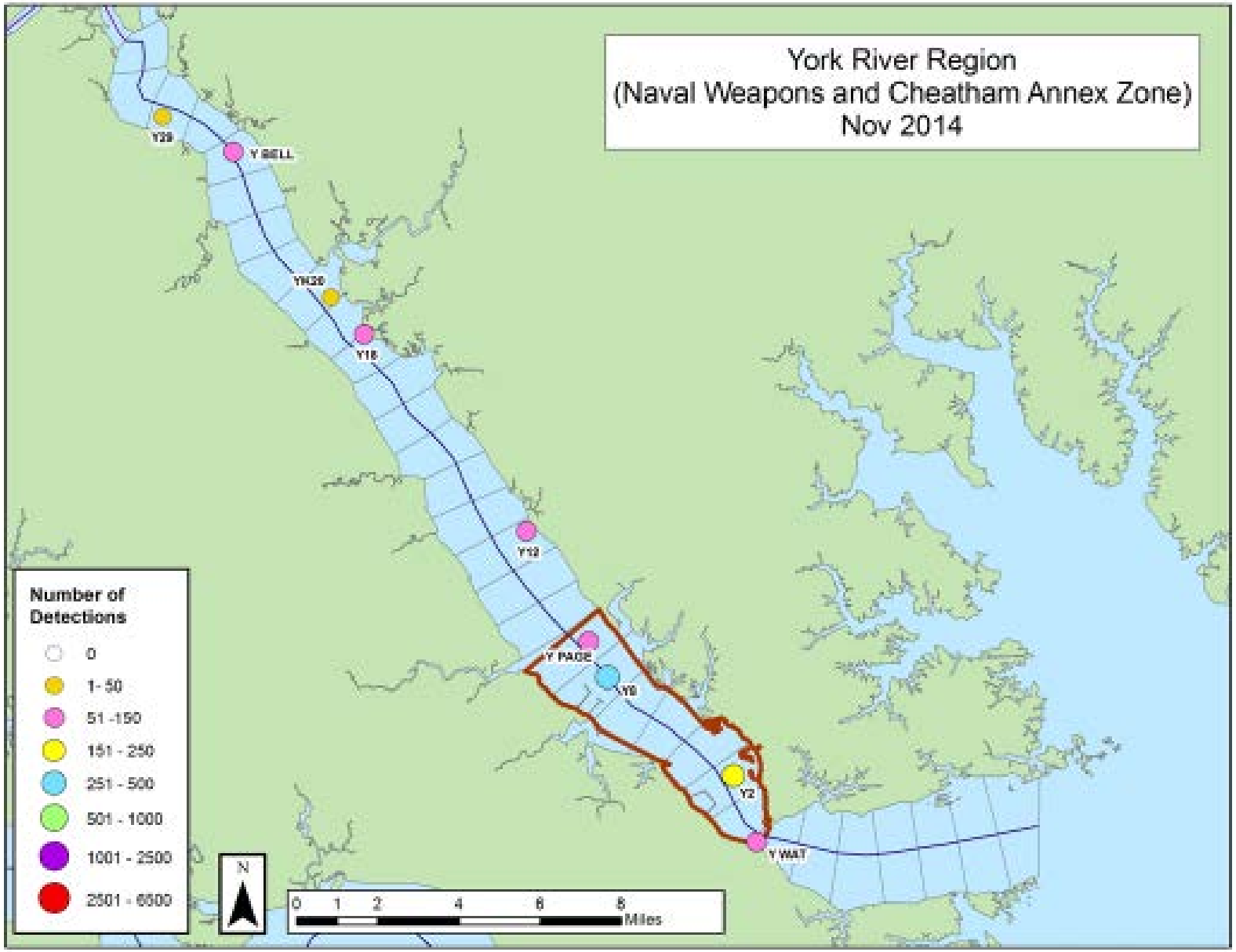

York River Region
(Naval Weapons and Cheatham Annex Zone)
Jun 2014
Y39
Y BELL
YN20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 1 2 4 6 8 Miles

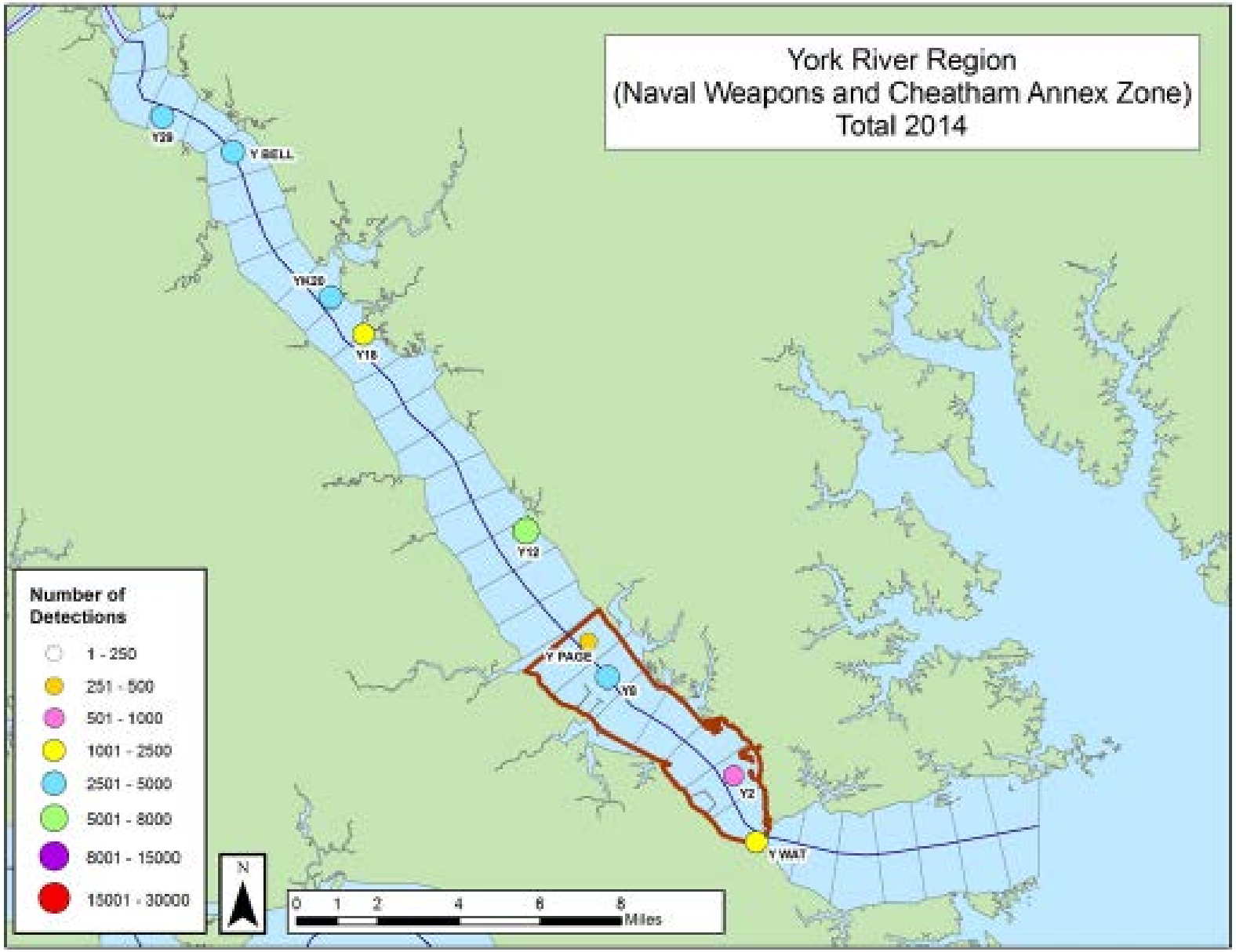

York River Region
(Naval Weapons and Cheatham Annex Zone)
Jul 2014
Y39
Y BELL
YN20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 1 2 4 6 8 Miles

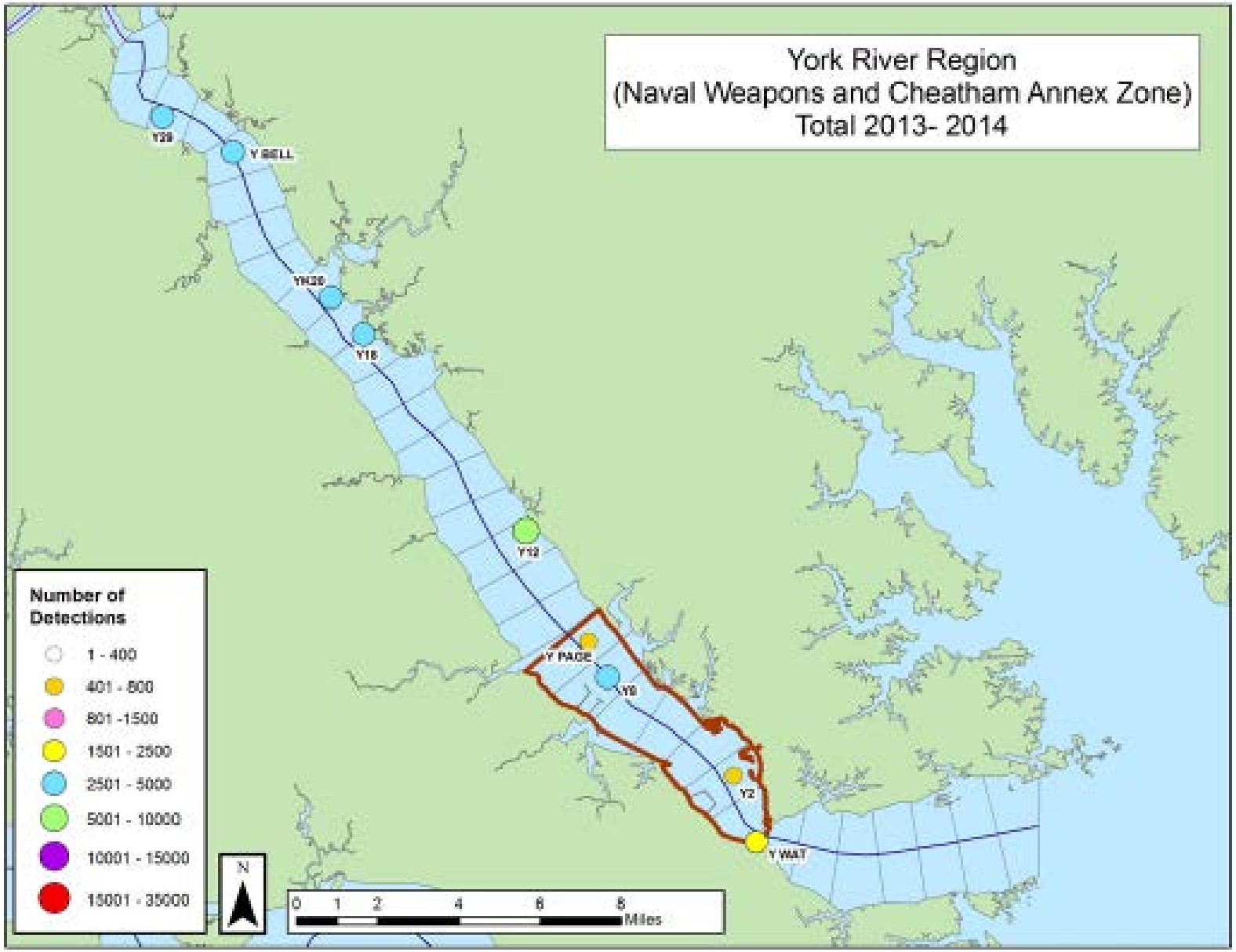

York River Region
(Naval Weapons and Cheatham Annex Zone)
Aug 2014
Y39
Y BELL
YN20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 1 2 4 6 8 Miles


York River Region
(Naval Weapons and Cheatham Annex Zone)
Sep 2014
Y BELL
Y12
Y PAGE
Y2
Y WAT
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 1 2 4 6 8 Miles

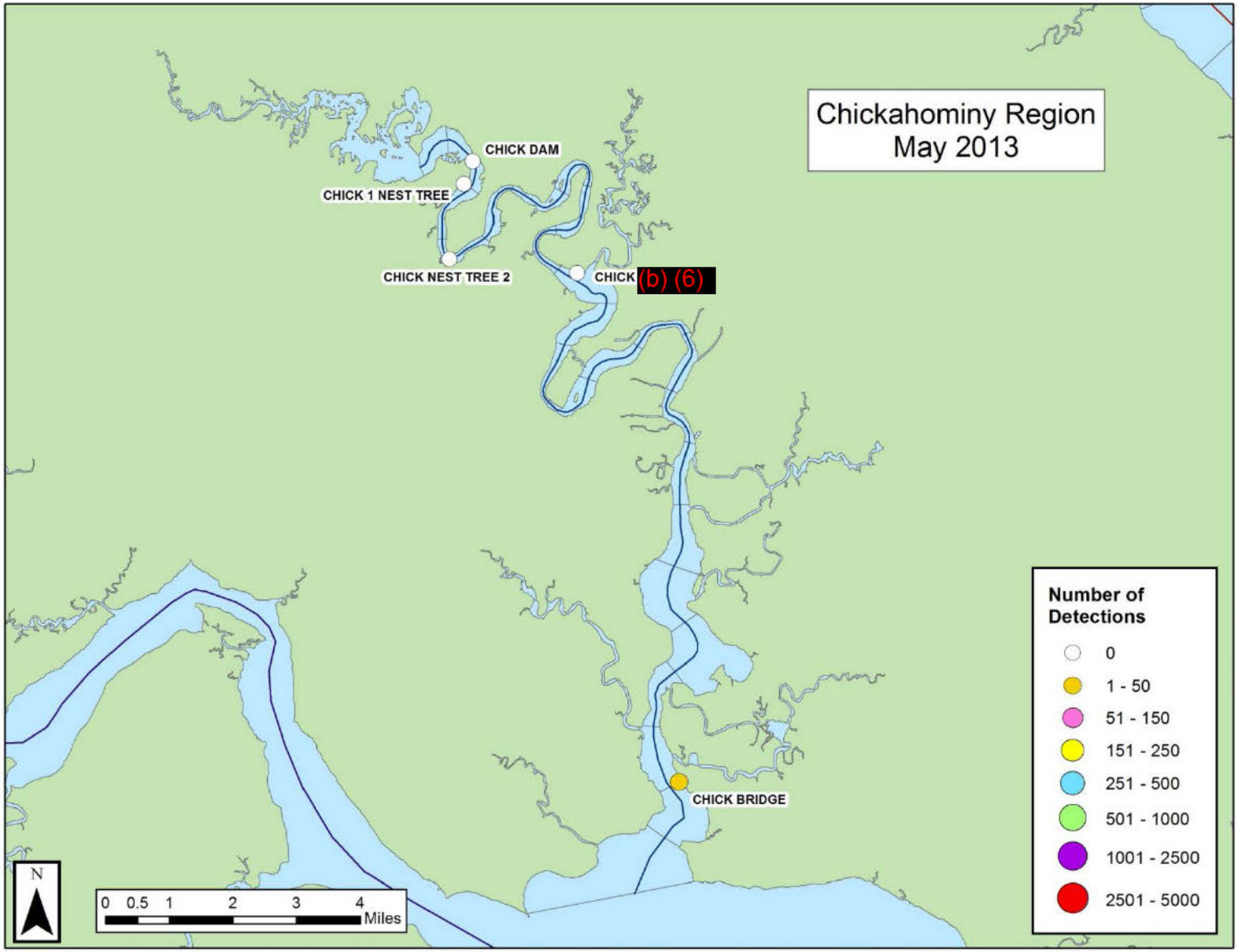

York River Region
(Naval Weapons and Cheatham Annex Zone)
Oct 2014
Y39
Y BELL
YN20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 1 2 4 6 8 Miles

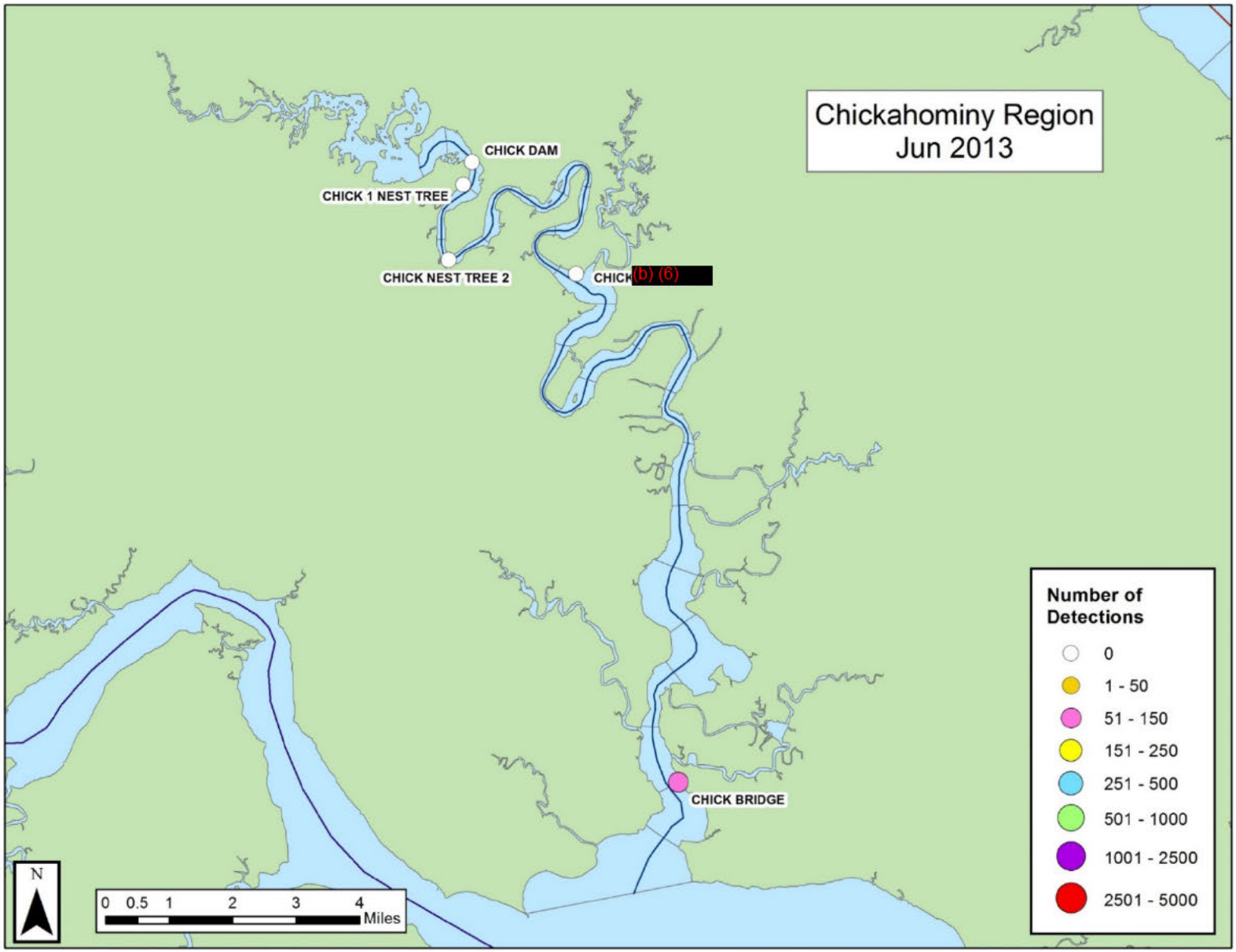

York River Region
(Naval Weapons and Cheatham Annex Zone)
Nov 2014
Y39
Y BELL
YN20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 1 2 4 6 8 Miles

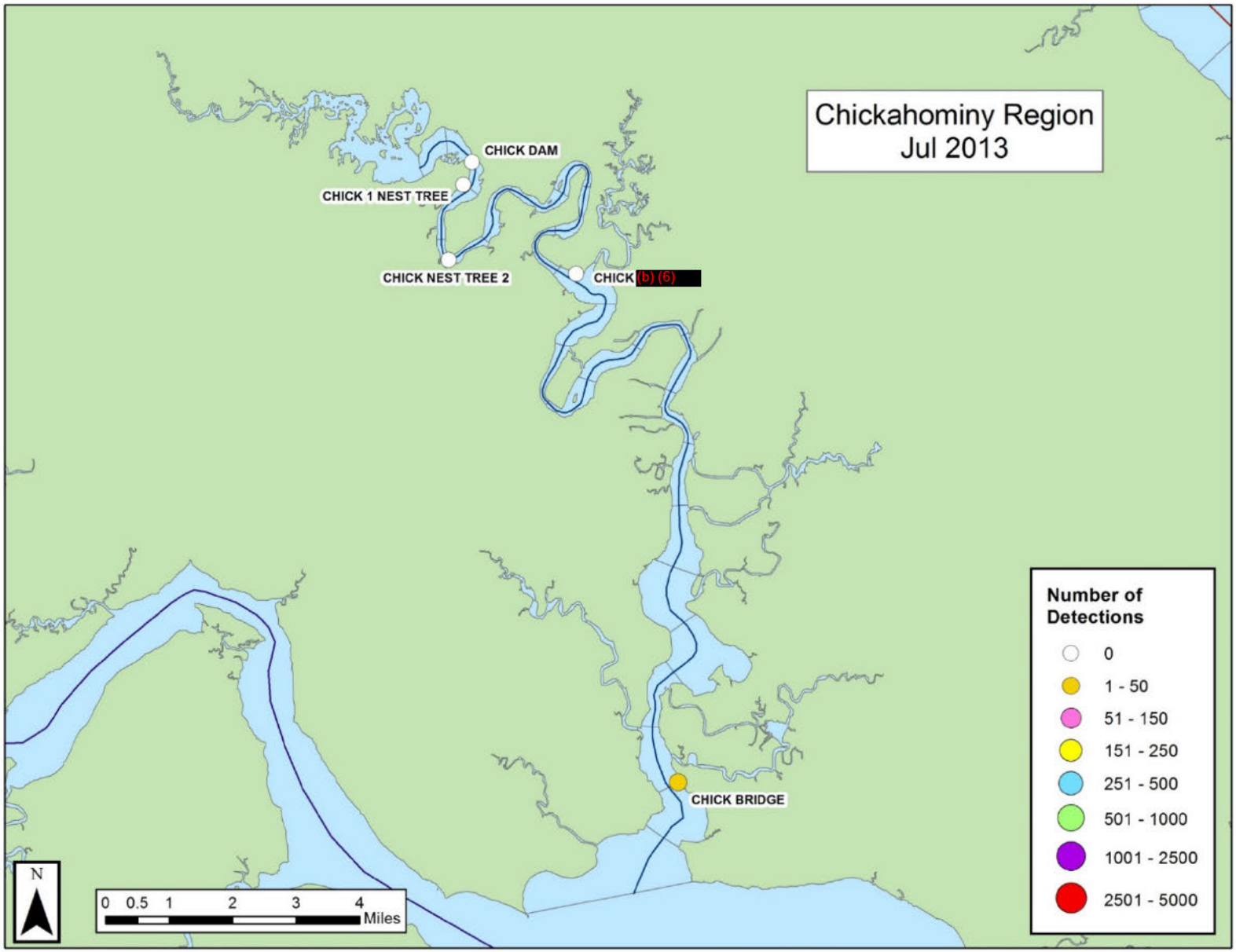

York River Region
(Naval Weapons and Cheatham Annex Zone)
Total 2014
Y39
Y BELL
YN20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
1 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
5001 - 8000
8001 - 15000
15001 - 30000
N
0 1 2 4 6 8 Miles

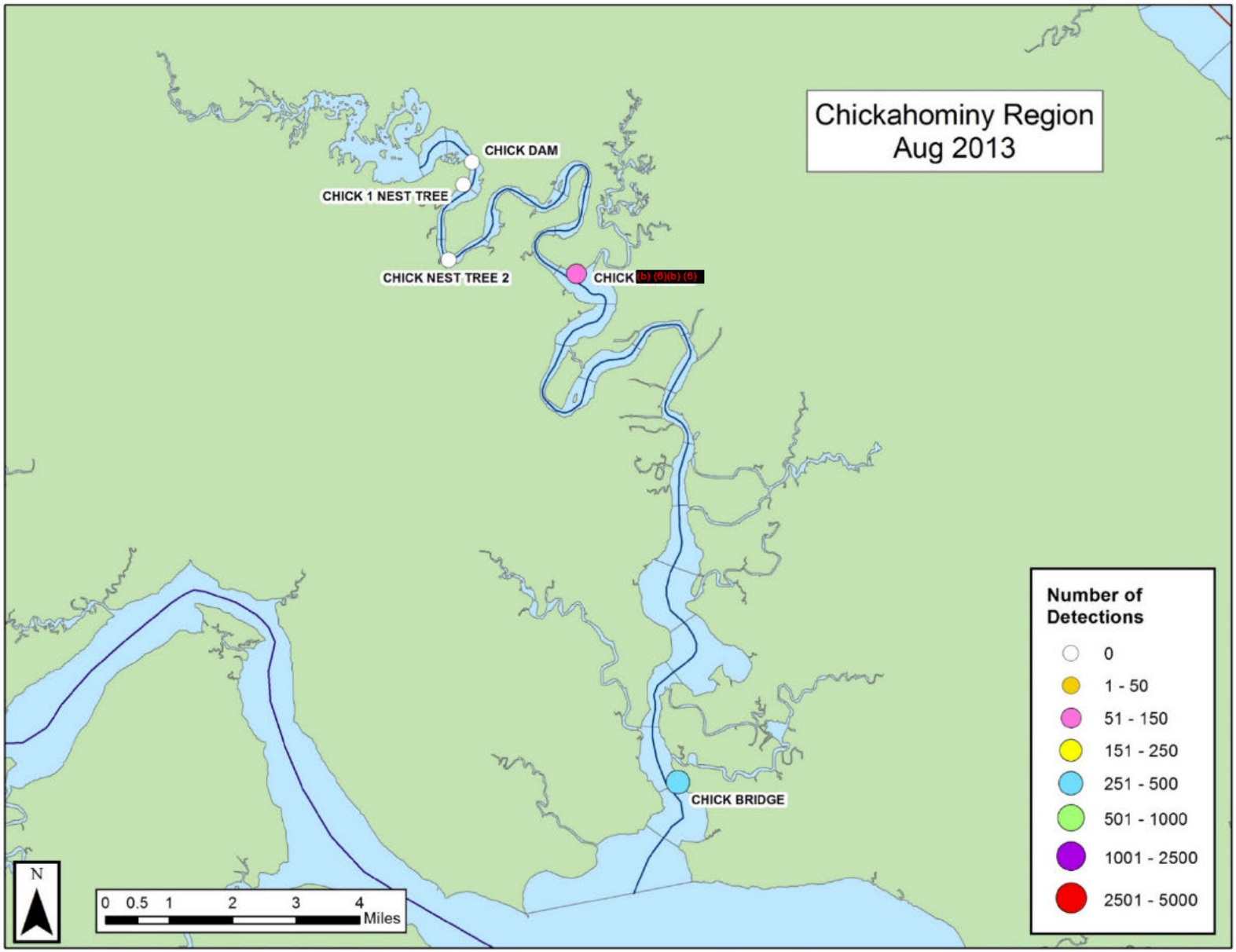

York River Region
(Naval Weapons and Cheatham Annex Zone)
Total 2013- 2014
Y39
Y BELL
YN20
Y18
Y12
Y PAGE
Y8
Y2
Y WAT
Number of Detections
1 - 400
401 - 800
801 -1500
1501 - 2500
2501 - 5000
5001 - 10000
10001 - 15000
15001 - 35000
N
0 1 2 4 6 8 Miles

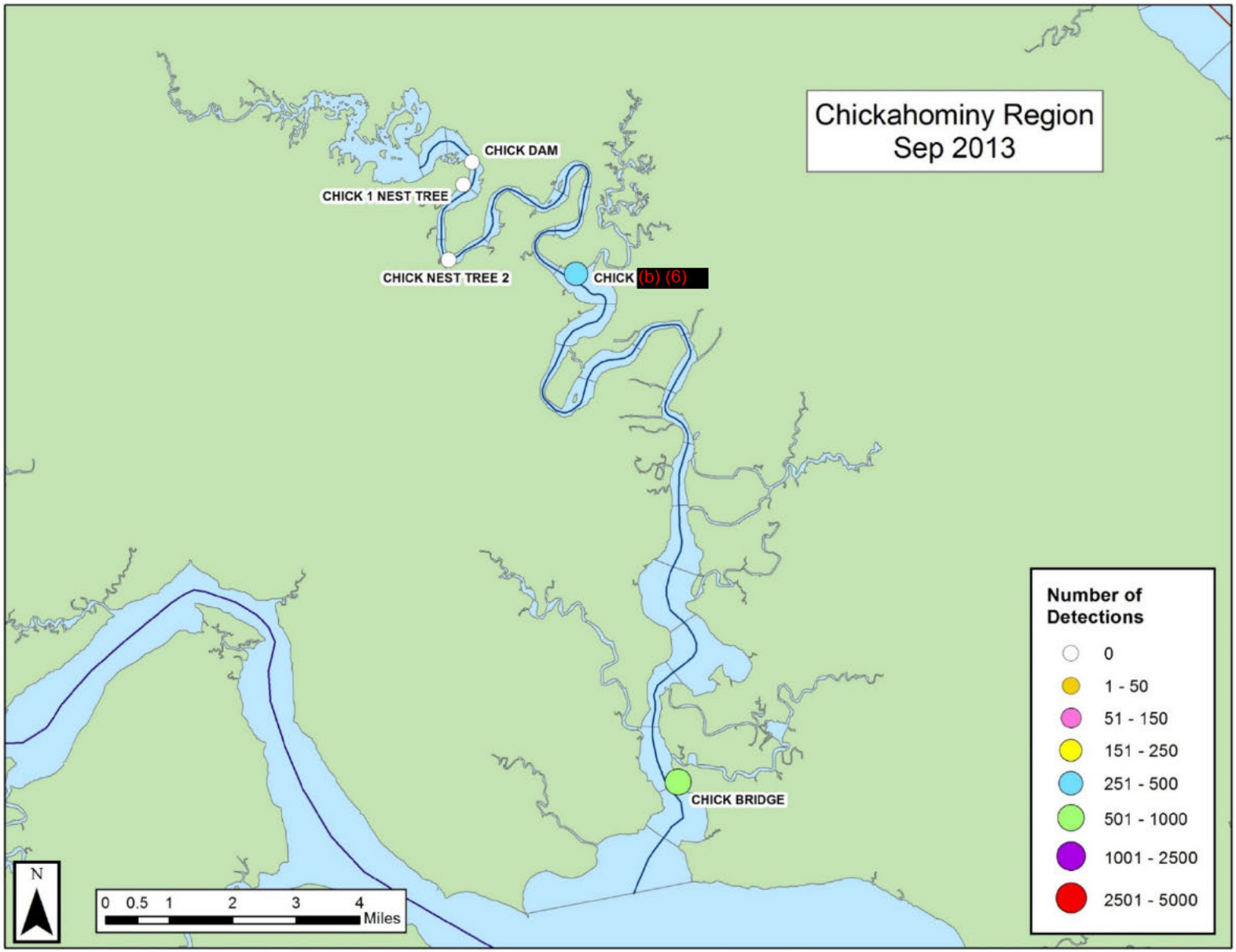
9.5 APPENDIX 4.4.3: CHICKAHOMINY REGION

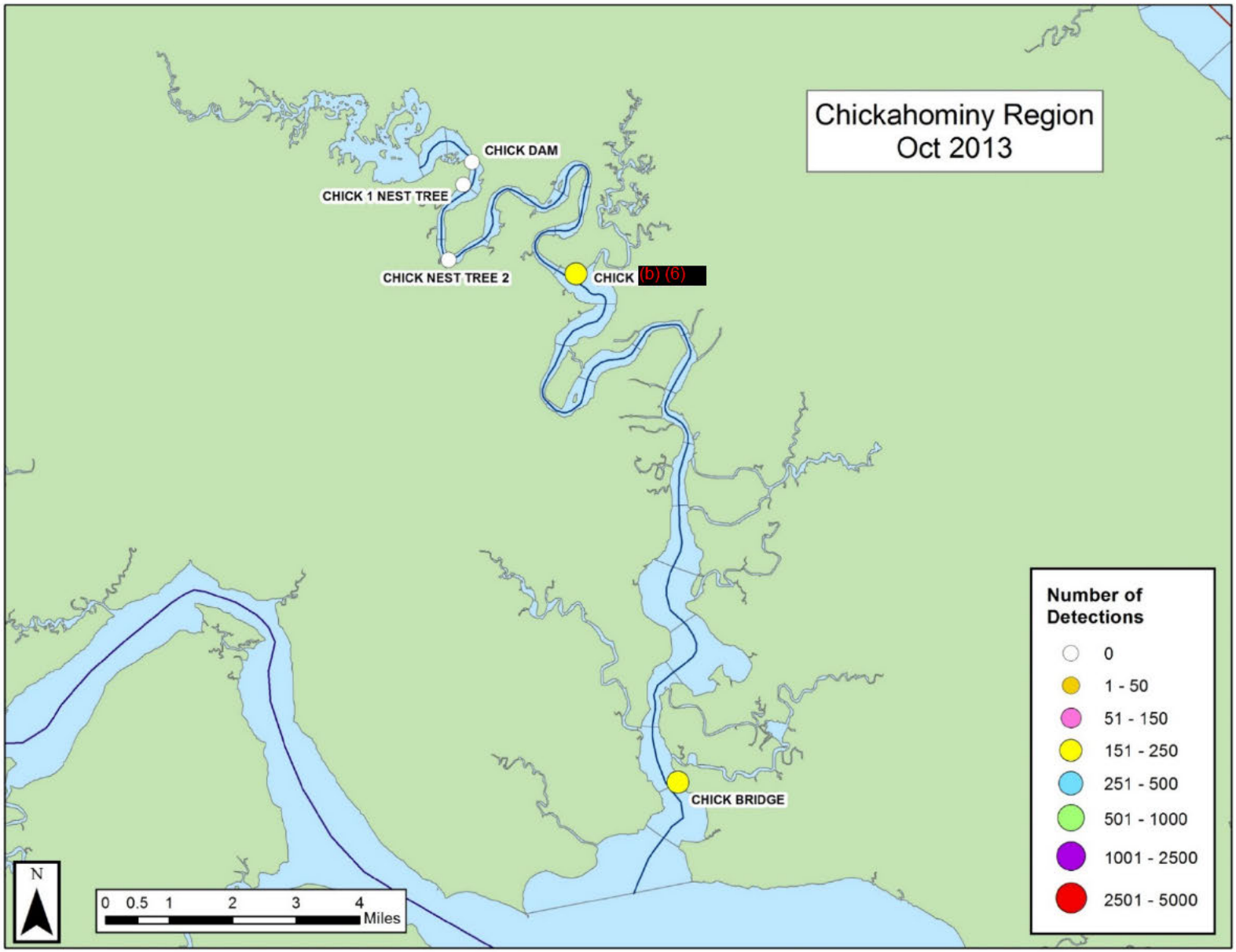


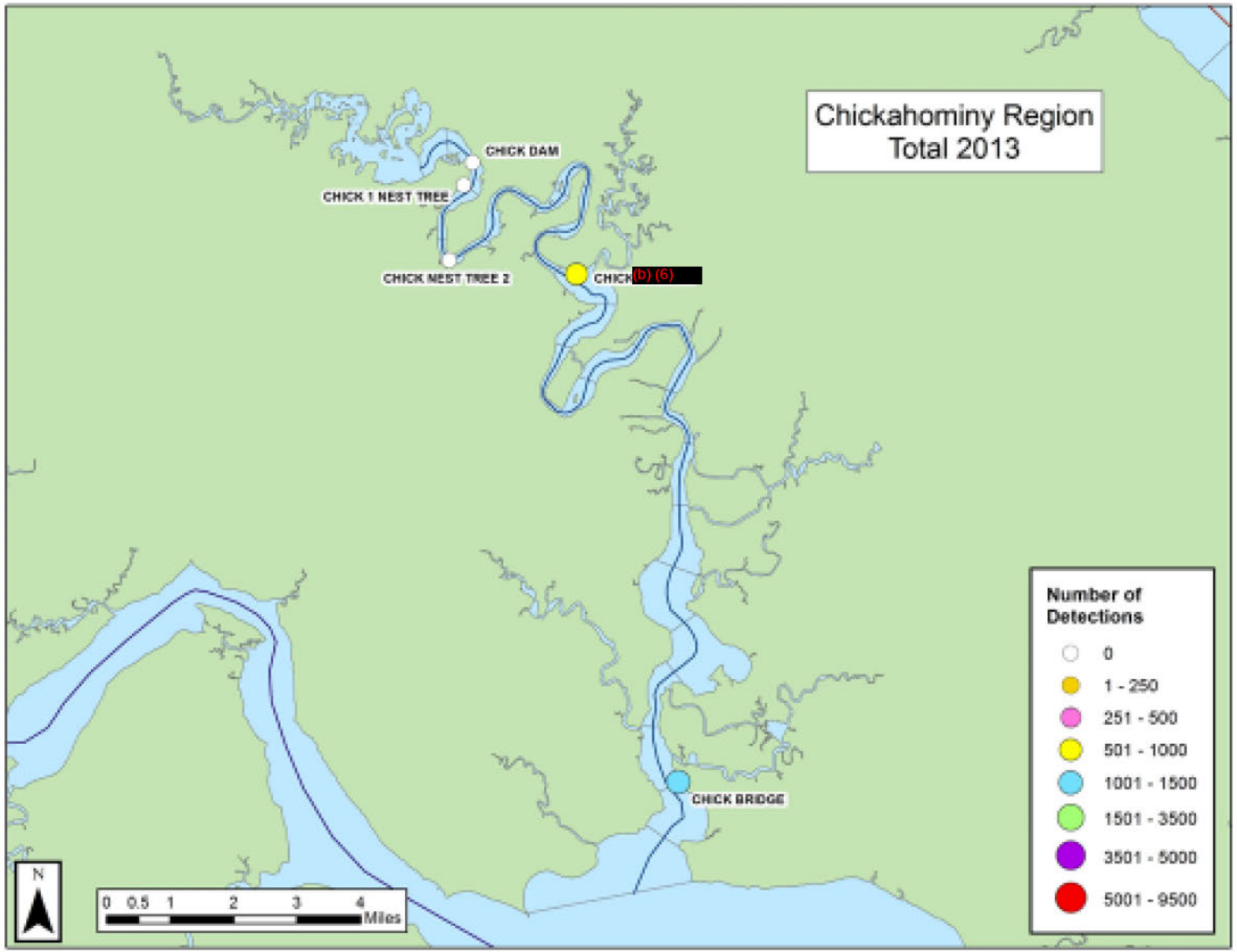

Chickahominy Region
Jun 2013
CHICK DAM
CHICK 1 NEST TREE
CHICK NEST TREE 2
CHICK (b) (6)
CHICK BRIDGE
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

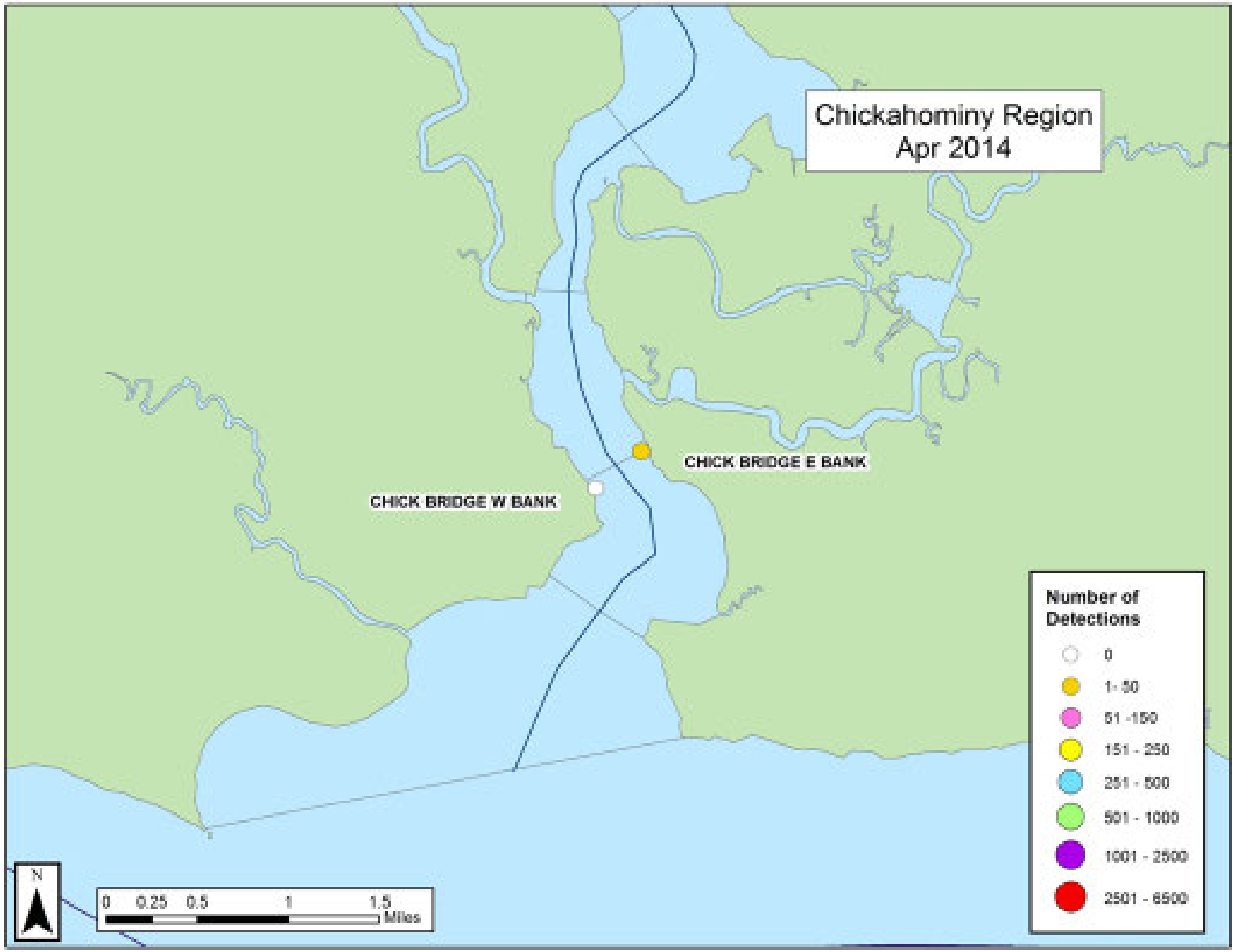

Chickahominy Region
Jul 2013
CHICK DAM
CHICK 1 NEST TREE
CHICK NEST TREE 2
CHICK (b) (6)
CHICK BRIDGE
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

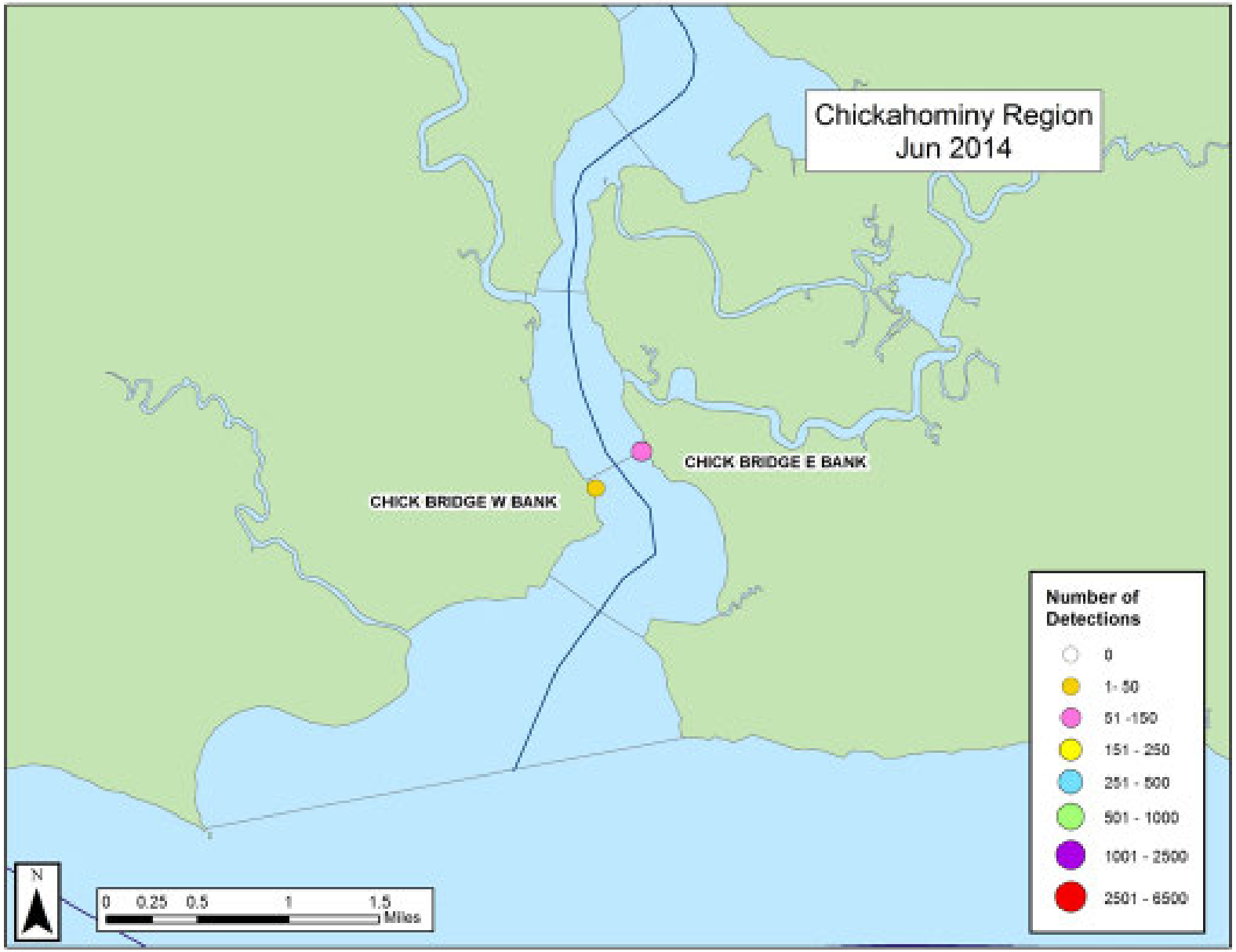

Chickahominy Region
Aug 2013
CHICK DAM
CHICK 1 NEST TREE
CHICK NEST TREE 2
CHICK (b) (6)(b) (6)
CHICK BRIDGE
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

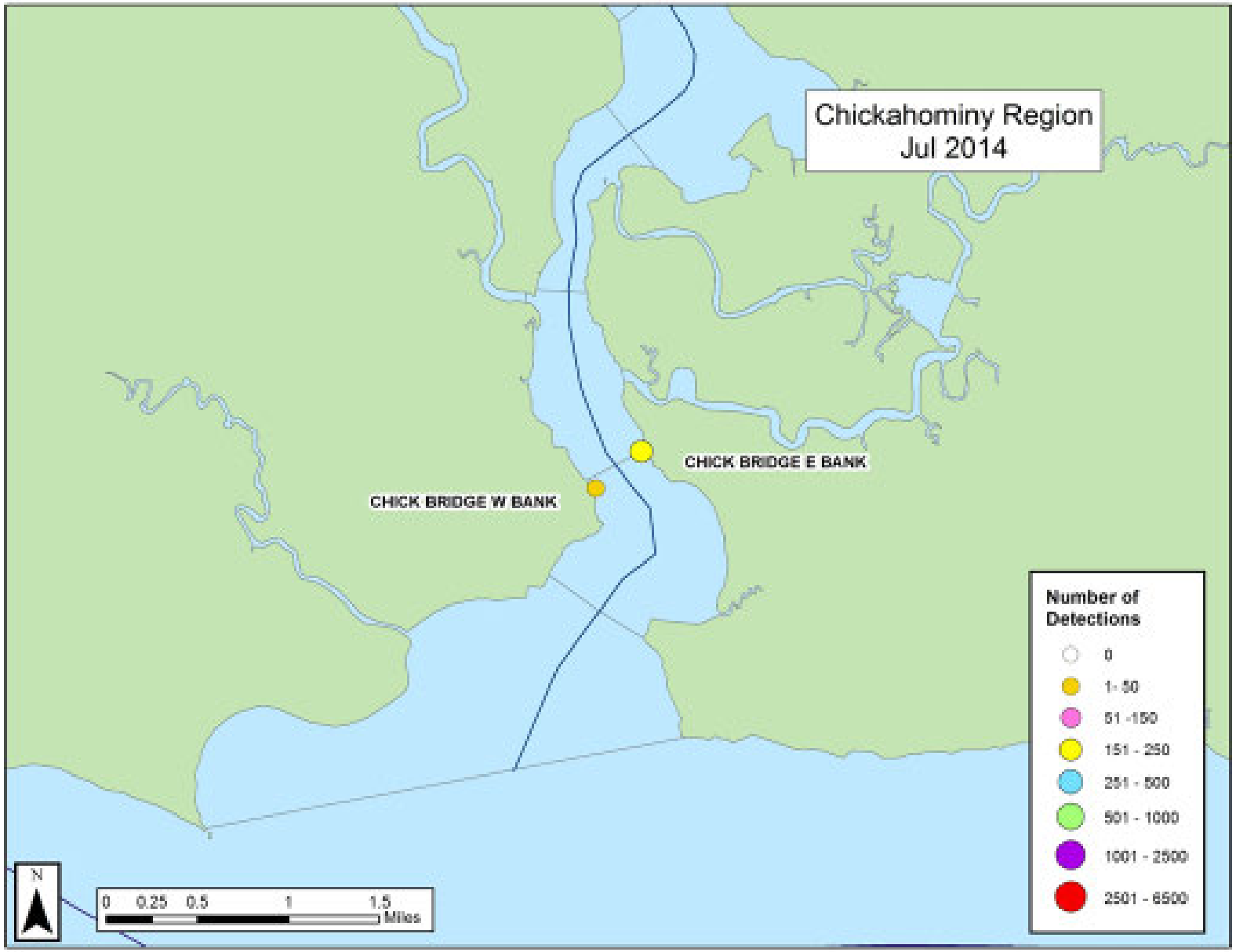

Chickahominy Region
Sep 2013
CHICK DAM
CHICK 1 NEST TREE
CHICK NEST TREE 2
CHICK (b) (6)
CHICK BRIDGE
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

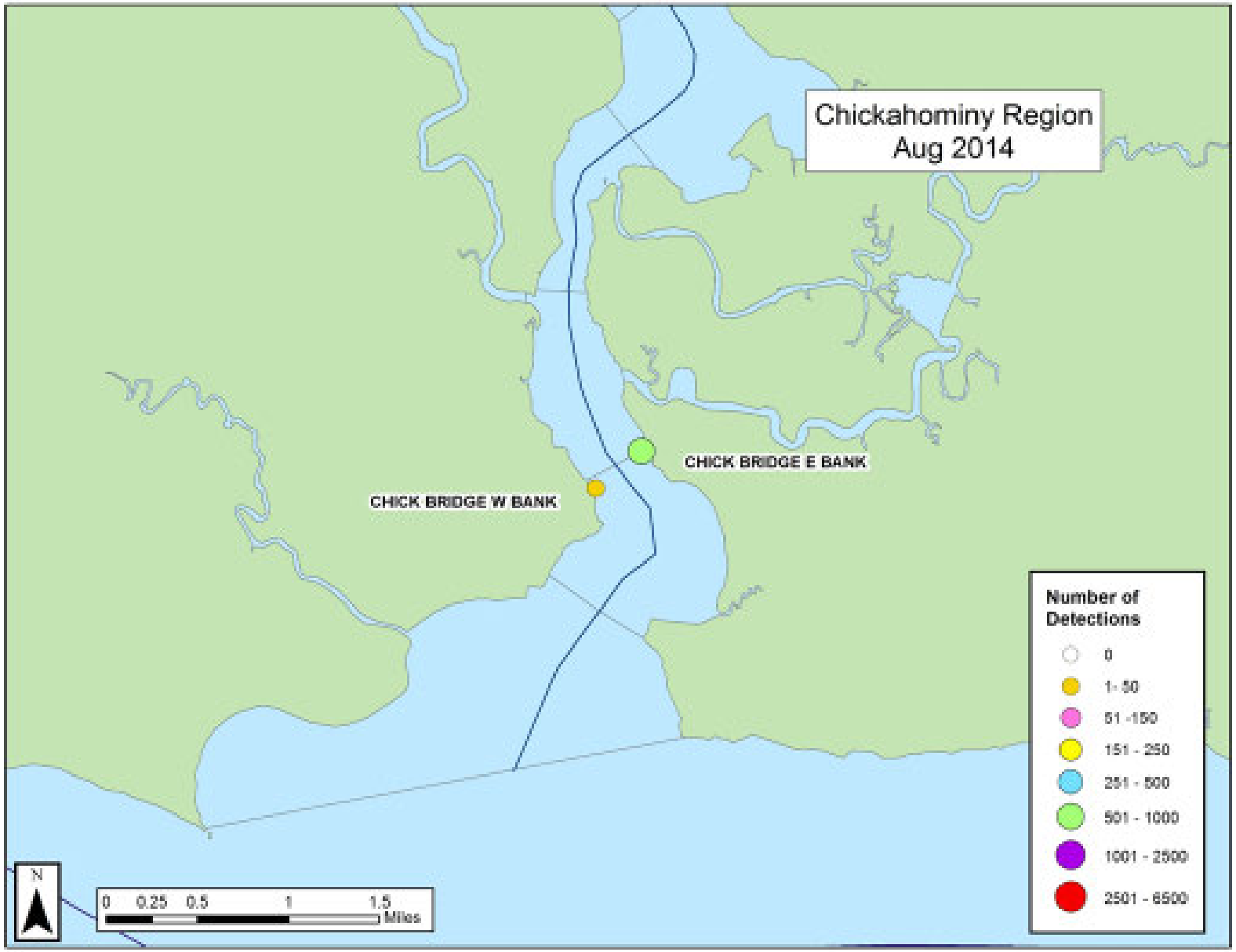

Chickahominy Region
Oct 2013
CHICK DAM
CHICK 1 NEST TREE
CHICK NEST TREE 2
CHICK (b) (6)
CHICK BRIDGE
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

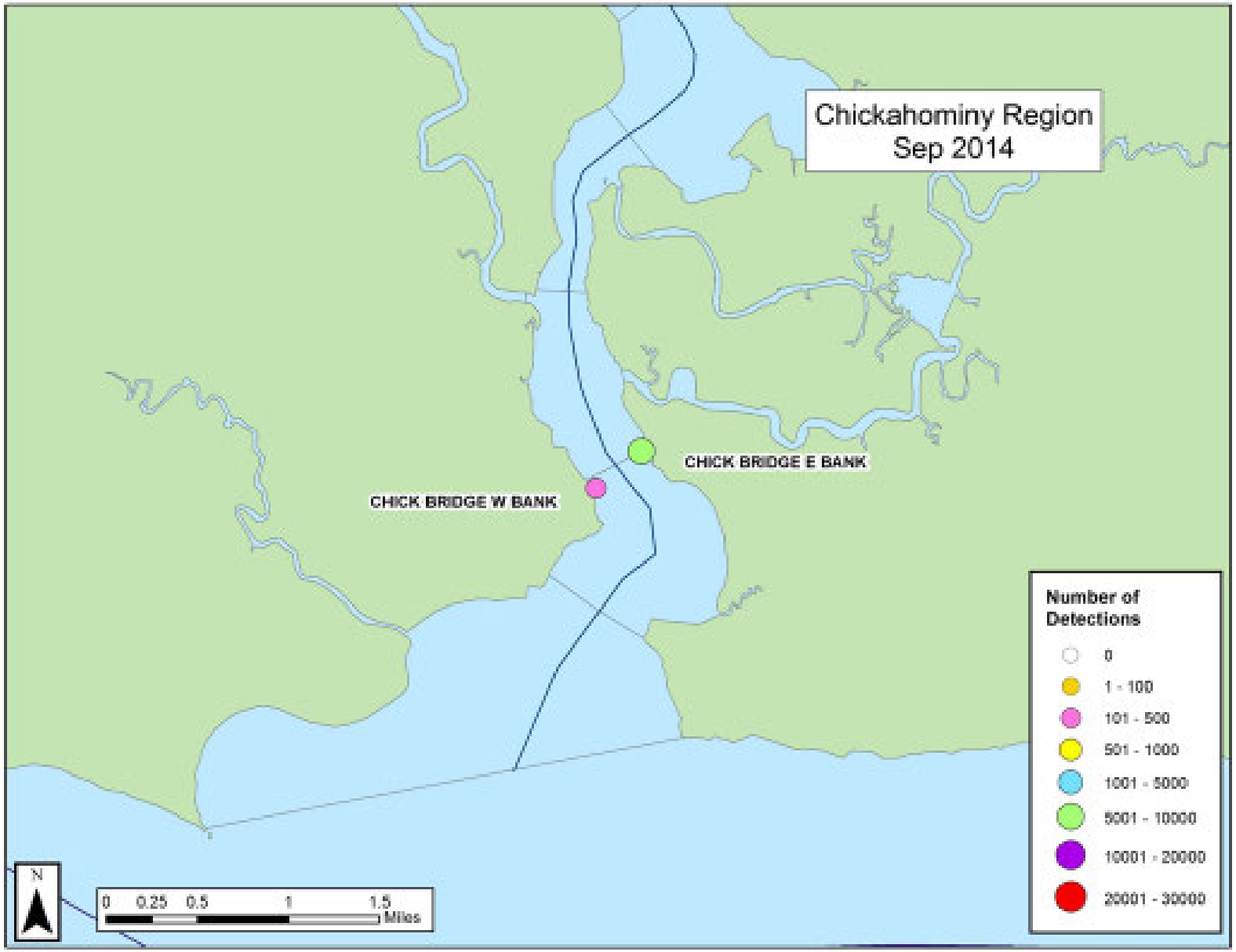

Chickahominy Region
Total 2013
CHICK DAM
CHICK 1 NEST TREE
CHICK NEST TREE 2
CHICK
(b) (6)
CHICK BRIDGE
Number of Detections
0
1 - 250
251 - 500
501 - 1000
1001 - 1500
1501 - 3500
3501 - 5000
5001 - 9500
N
0 0.5 1 2 3 4
Miles

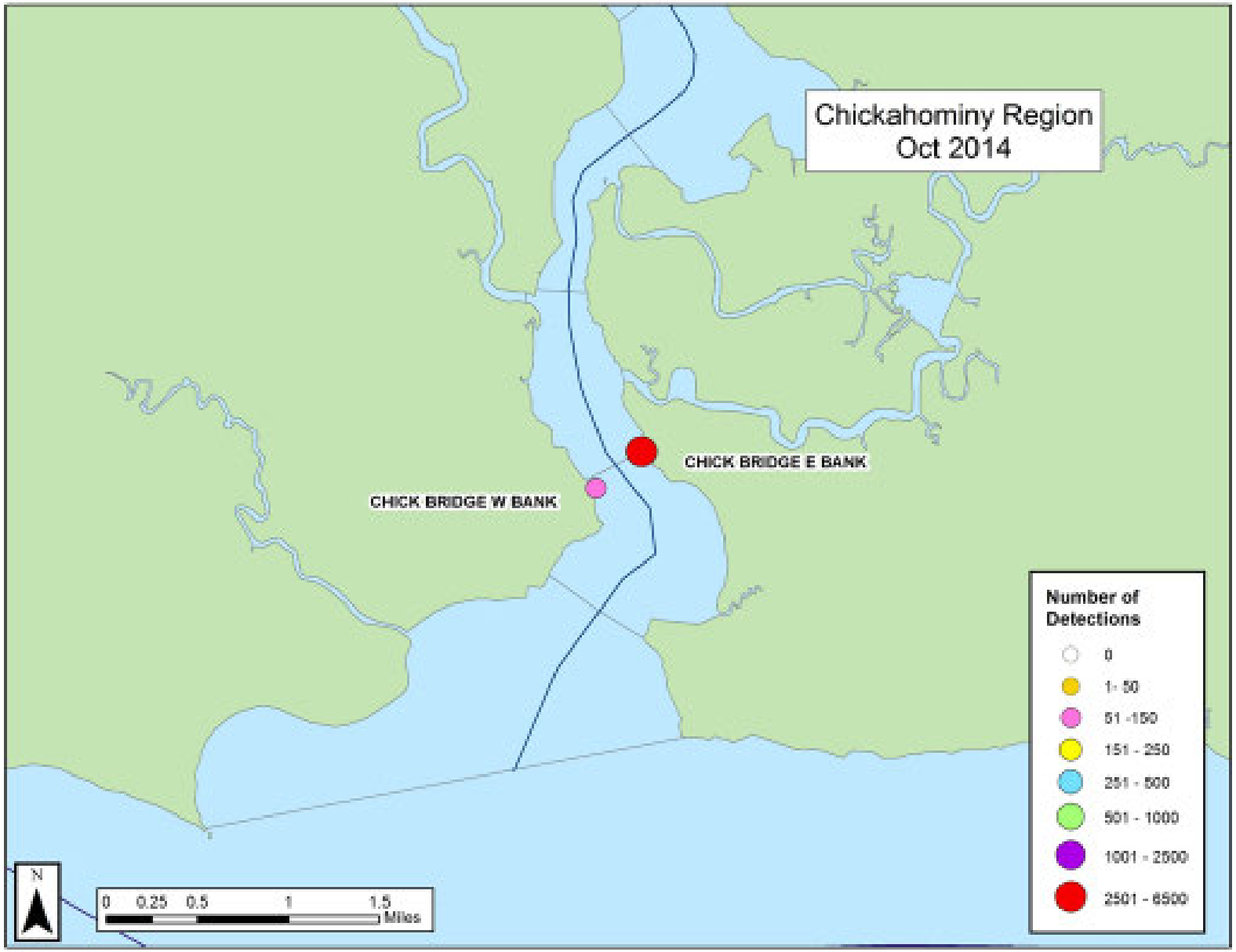

Chickahominy Region
Apr 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5
Miles

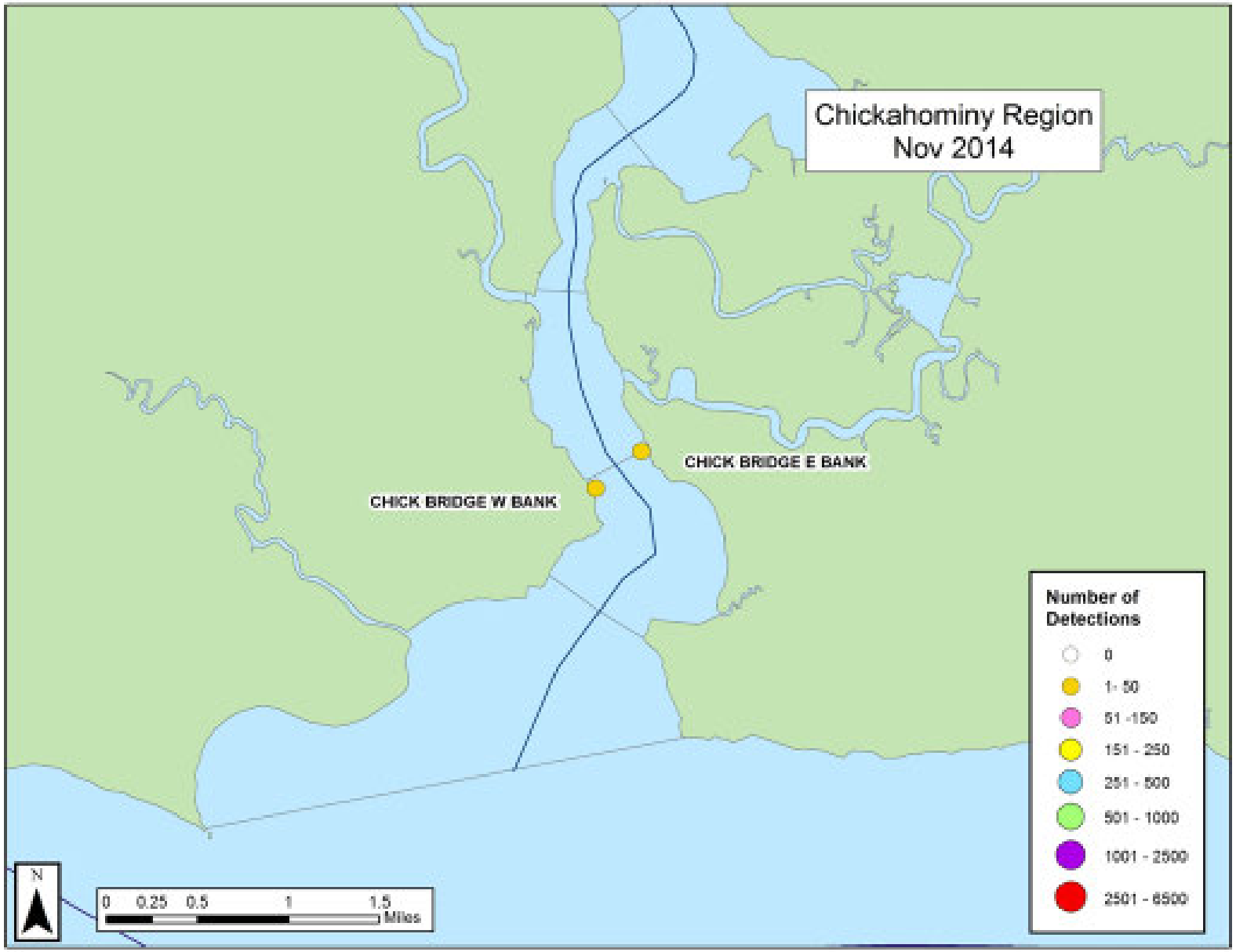

Chickahominy Region
Jun 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5
Miles

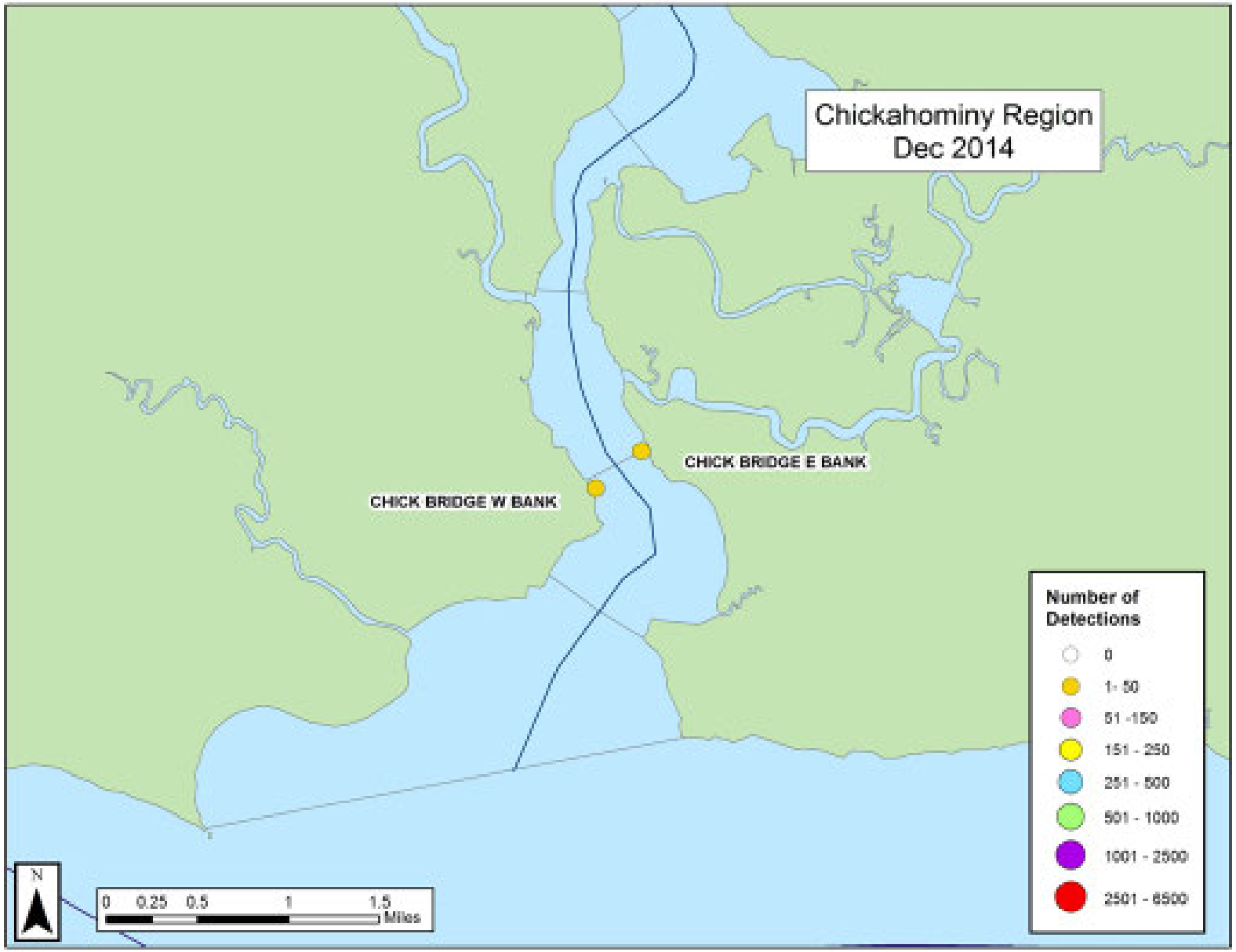

Chickahominy Region
Jul 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5
Miles

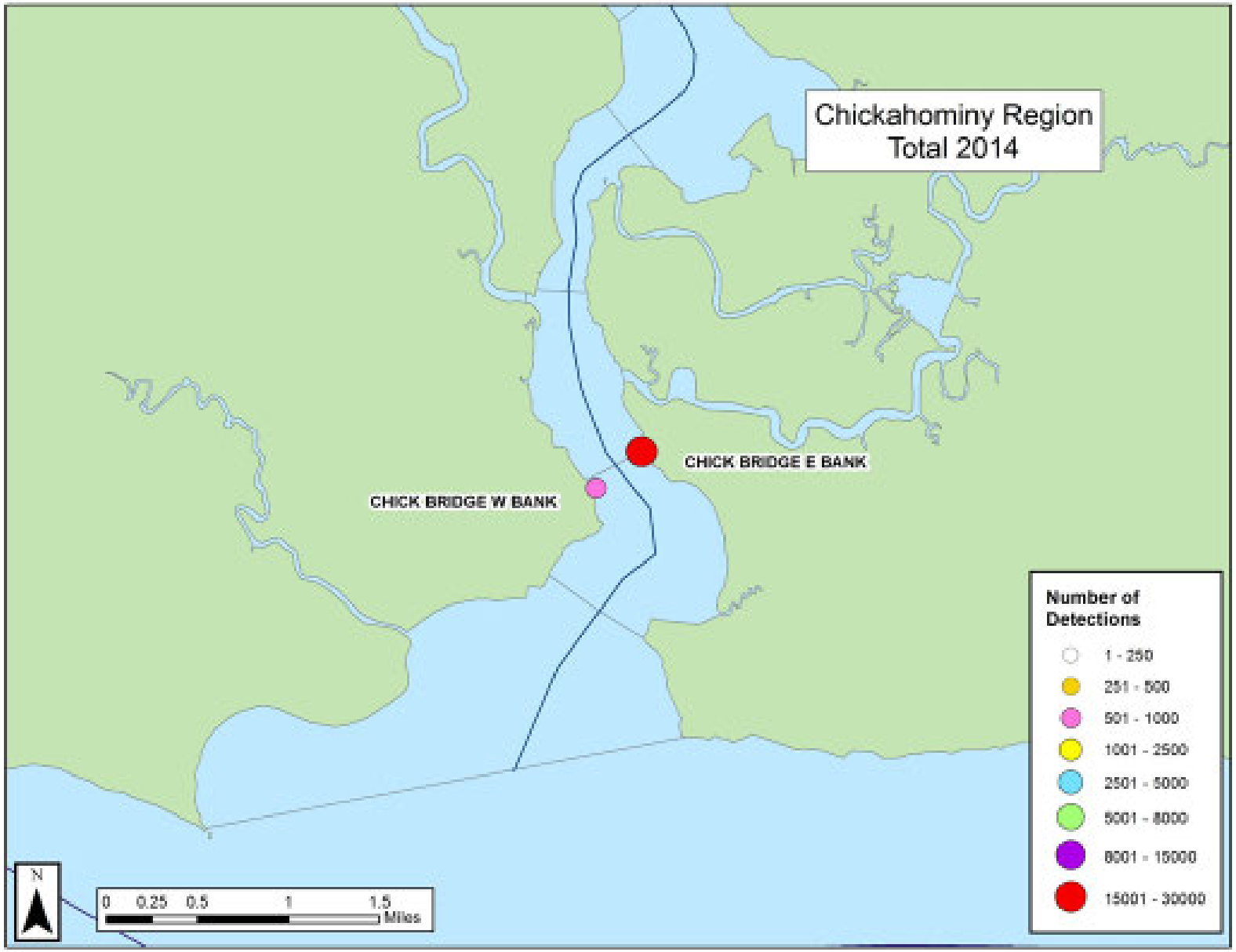

Chickahominy Region
Aug 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5
Miles

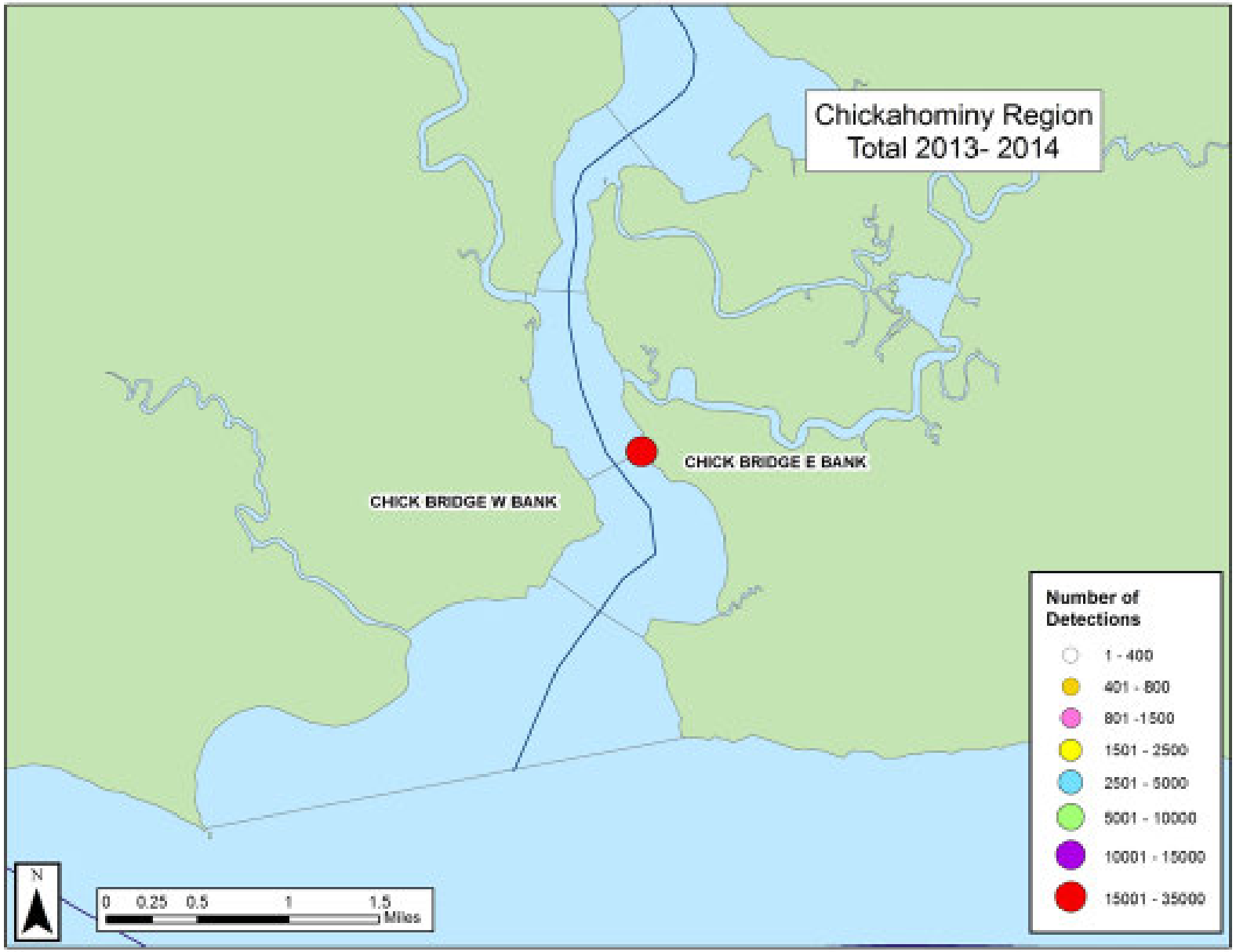

Chickahominy Region
Sep 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
0
1 - 100
101 - 500
501 - 1000
1001 - 5000
5001 - 10000
10001 - 20000
20001 - 30000
N
0 0.25 0.5 1 1.5
Miles


Chickahominy Region
Oct 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5
Miles

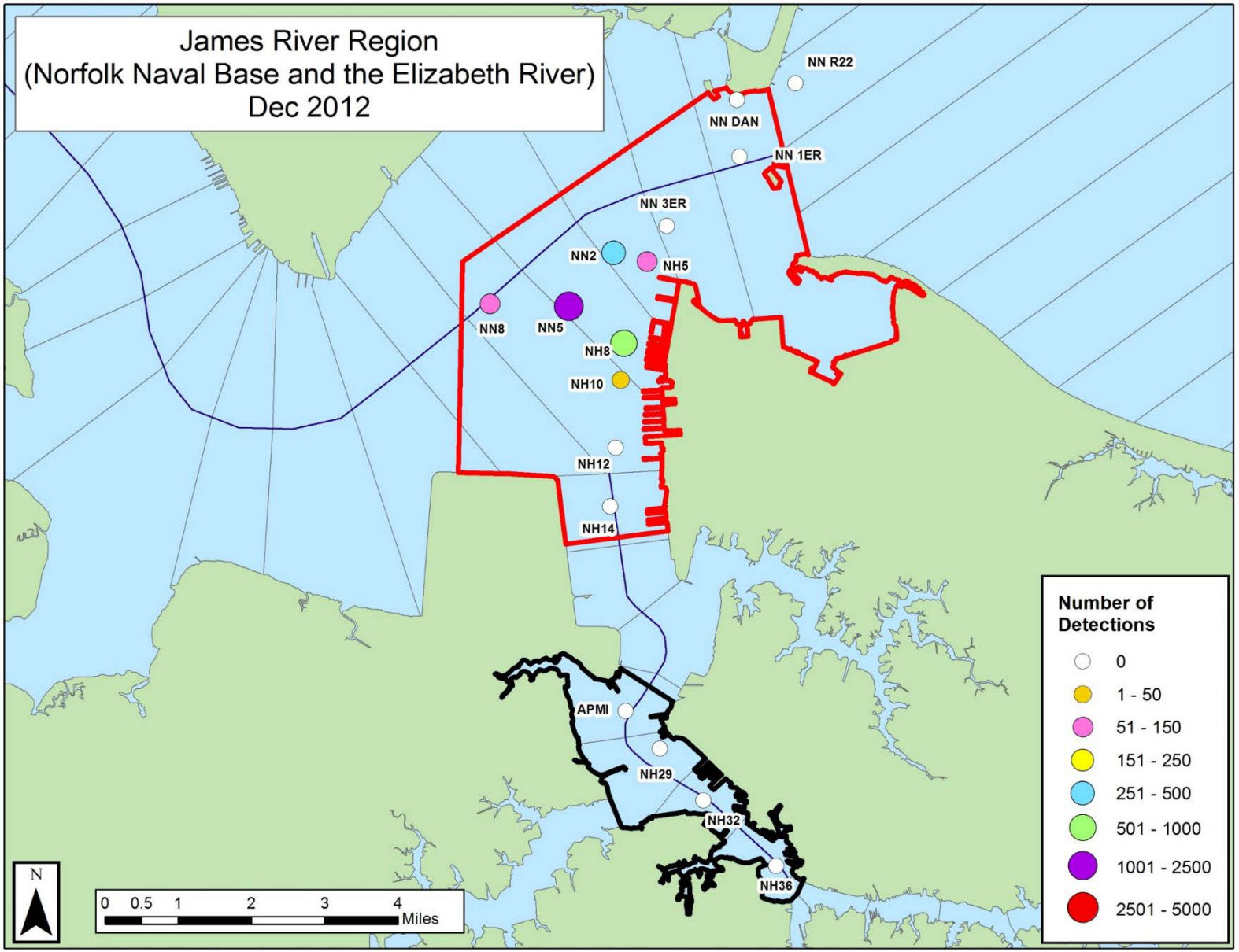

Chickahominy Region
Nov 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5
Miles

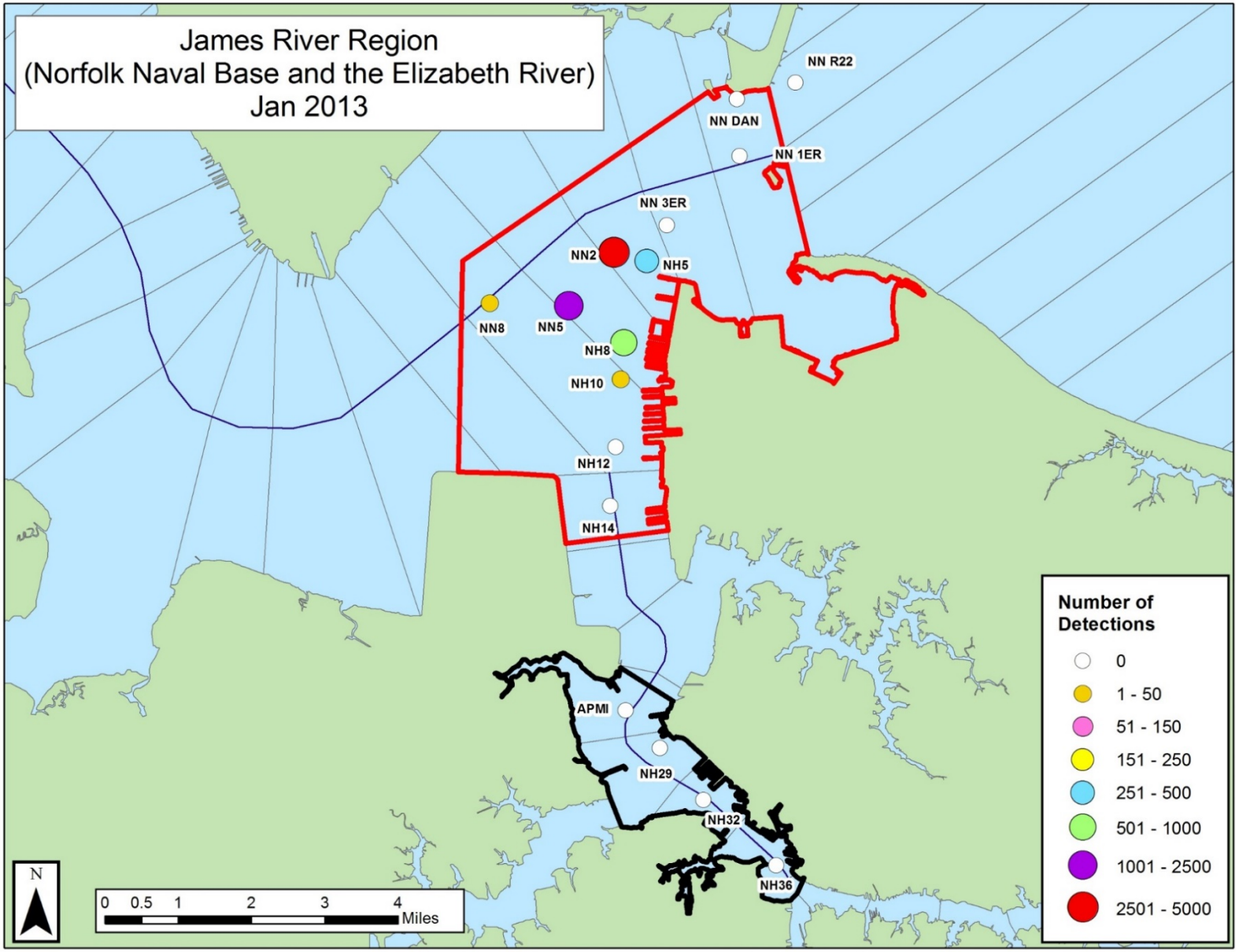

Chickahominy Region
Dec 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.25 0.5 1 1.5
Miles

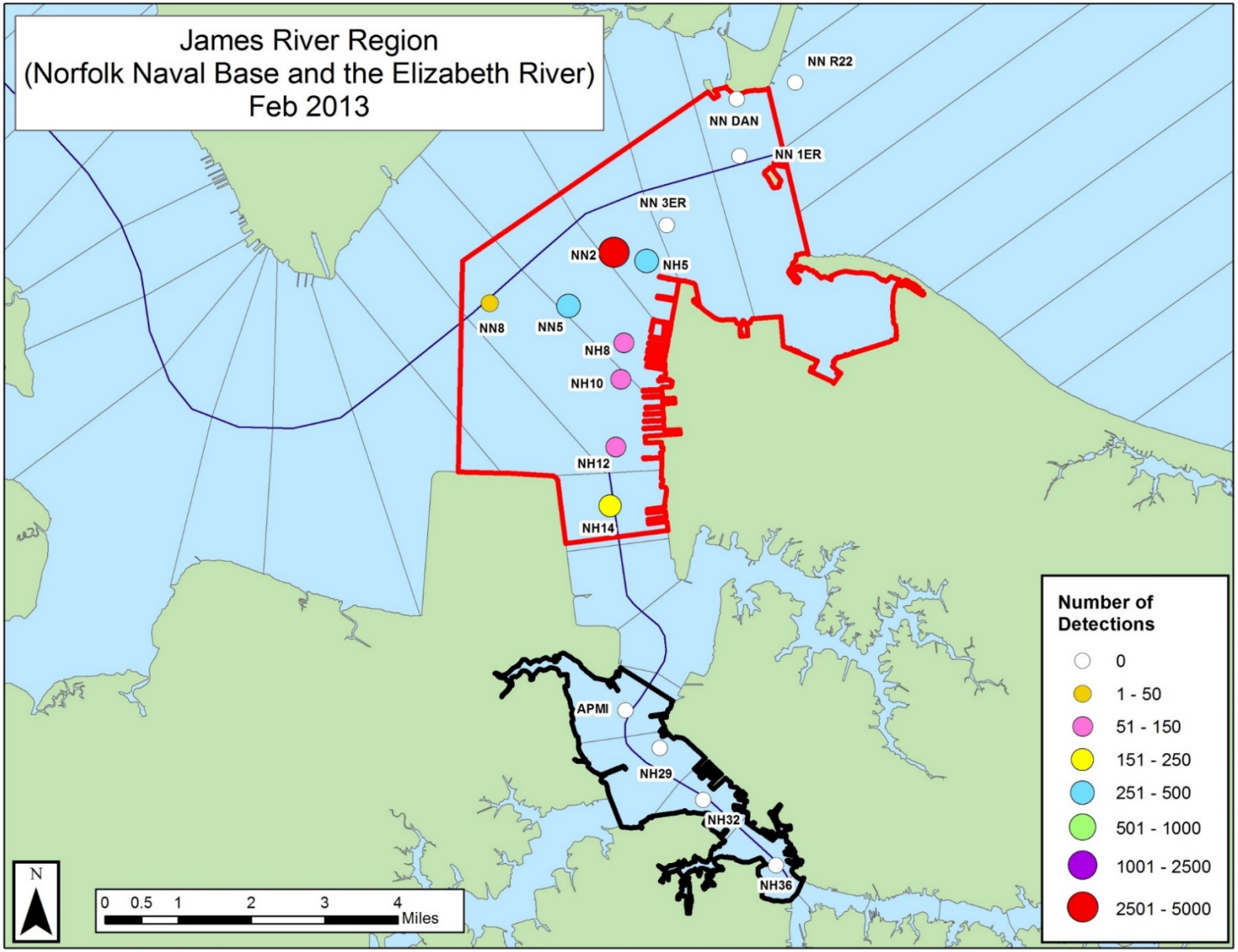

Chickahominy Region
Total 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
1 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
5001 - 8000
8001 - 15000
15001 - 30000
N
0 0.25 0.5 1 1.5
Miles

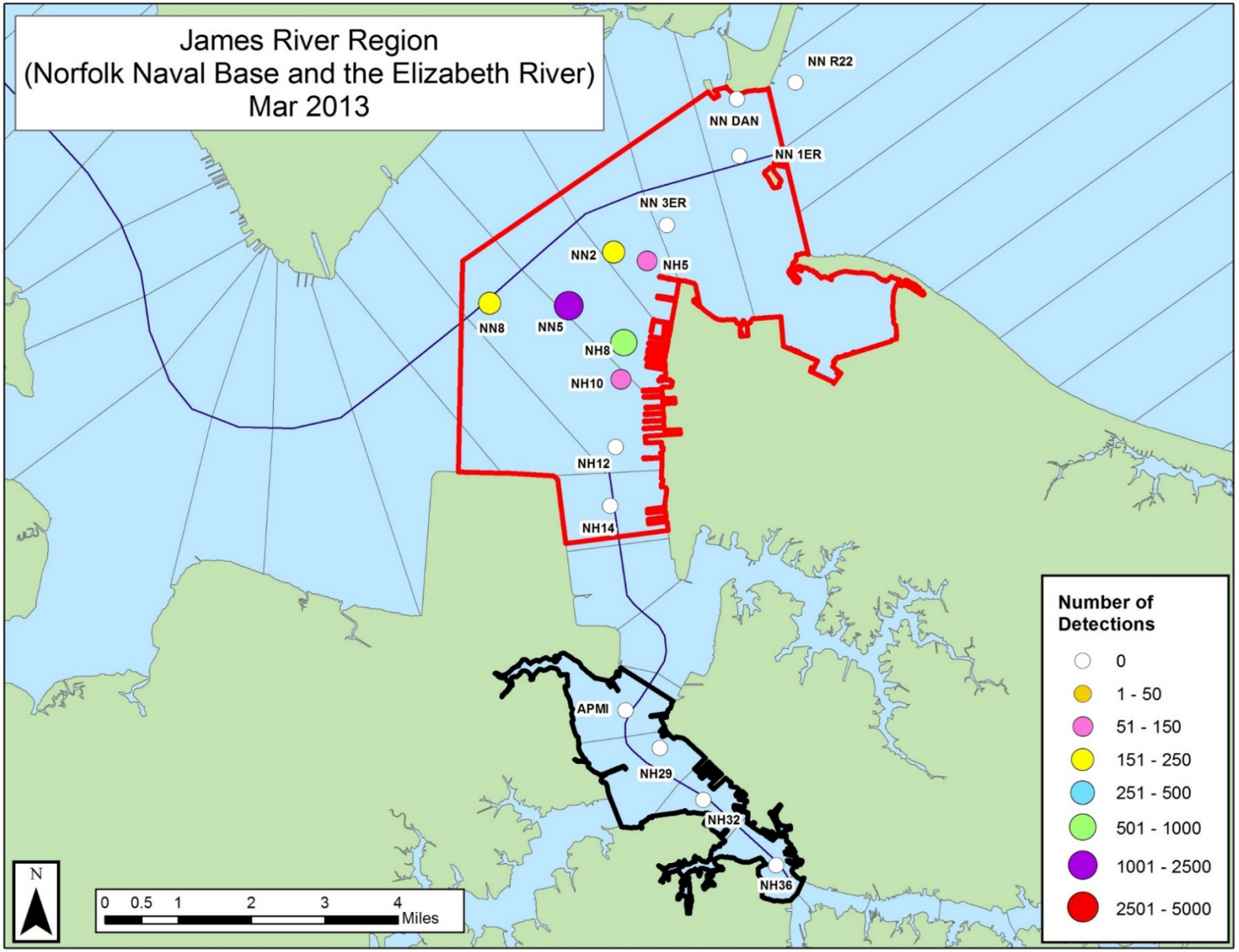

Chickahominy Region
Total 2013- 2014
CHICK BRIDGE E BANK
CHICK BRIDGE W BANK
Number of Detections
1 - 400
401 - 800
801 -1500
1501 - 2500
2501 - 5000
5001 - 10000
10001 - 15000
15001 - 35000
N
0 0.25 0.5 1 1.5
Miles

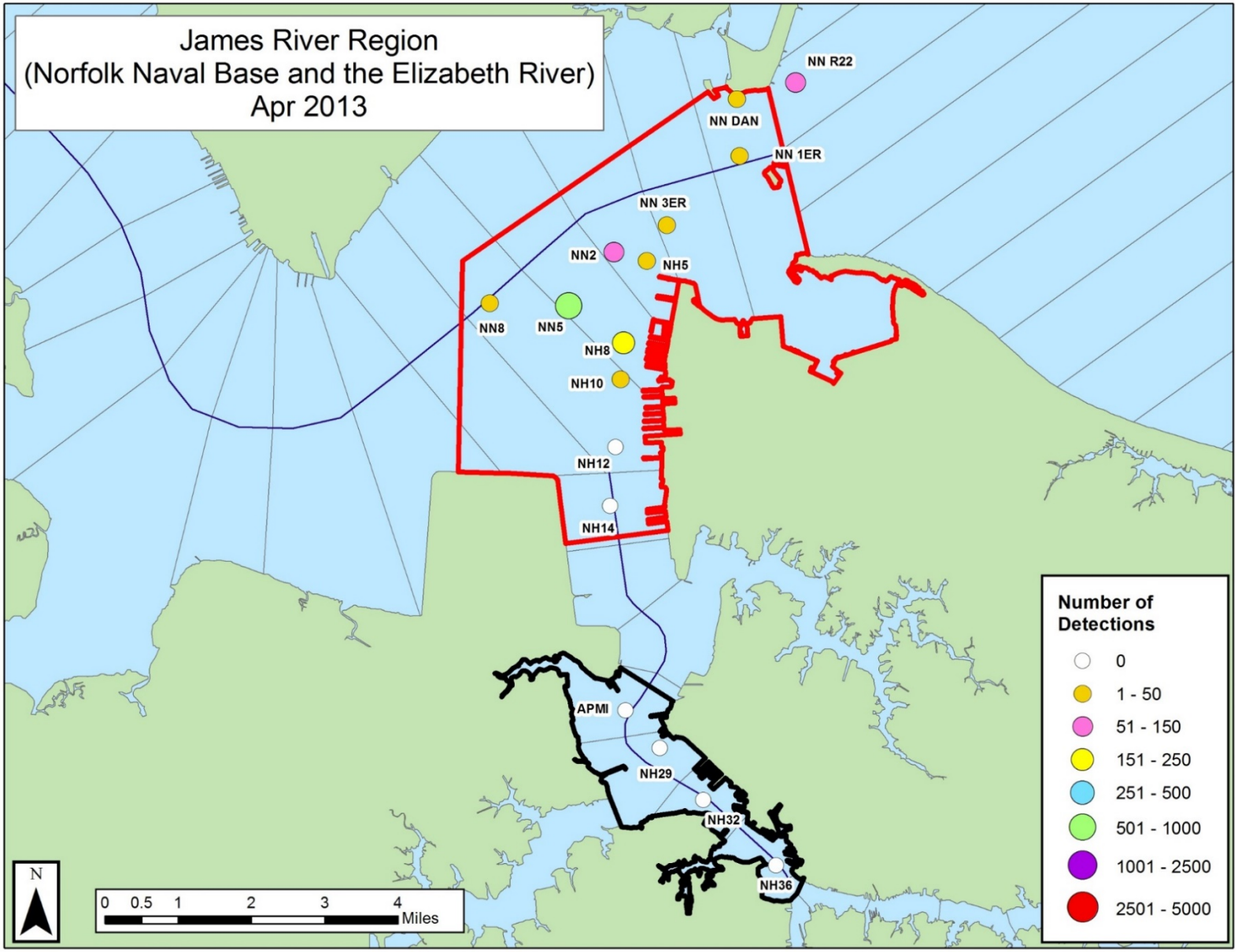
9.6 Appendix 4.4.4: James River Region (Norfolk Naval Base and Elizabeth River)

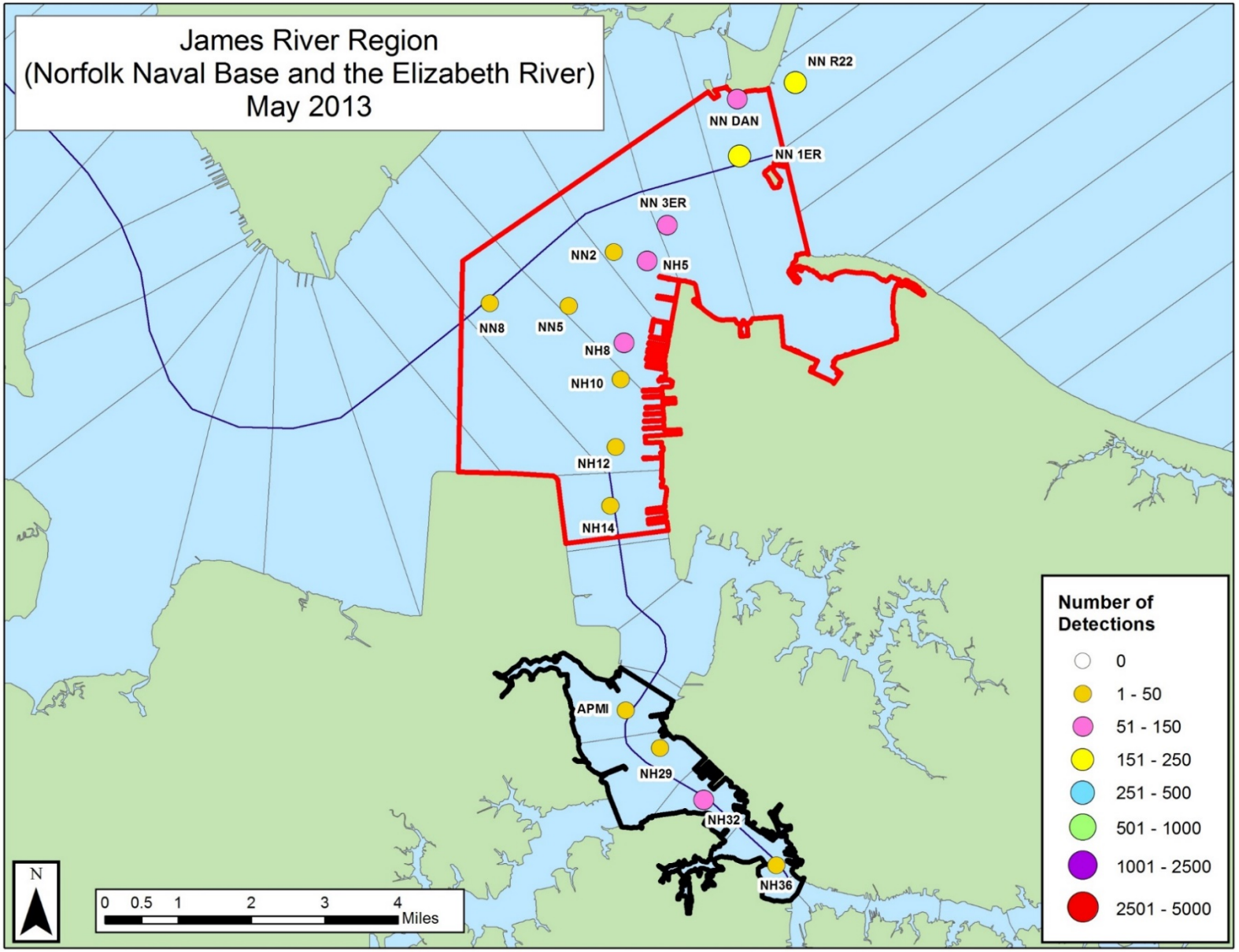


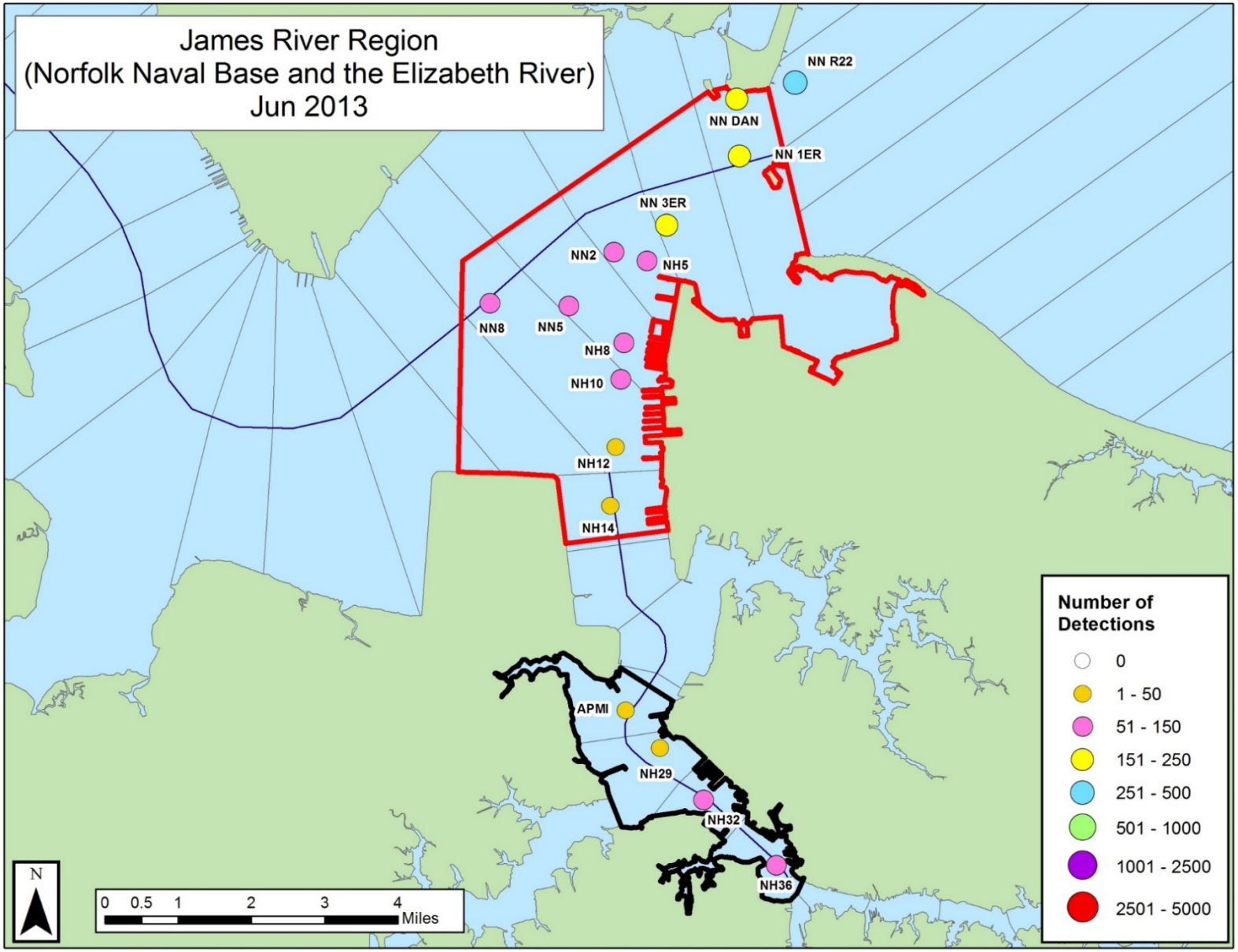

James River Region
(Norfolk Naval Base and the Elizabeth River)
Jan 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

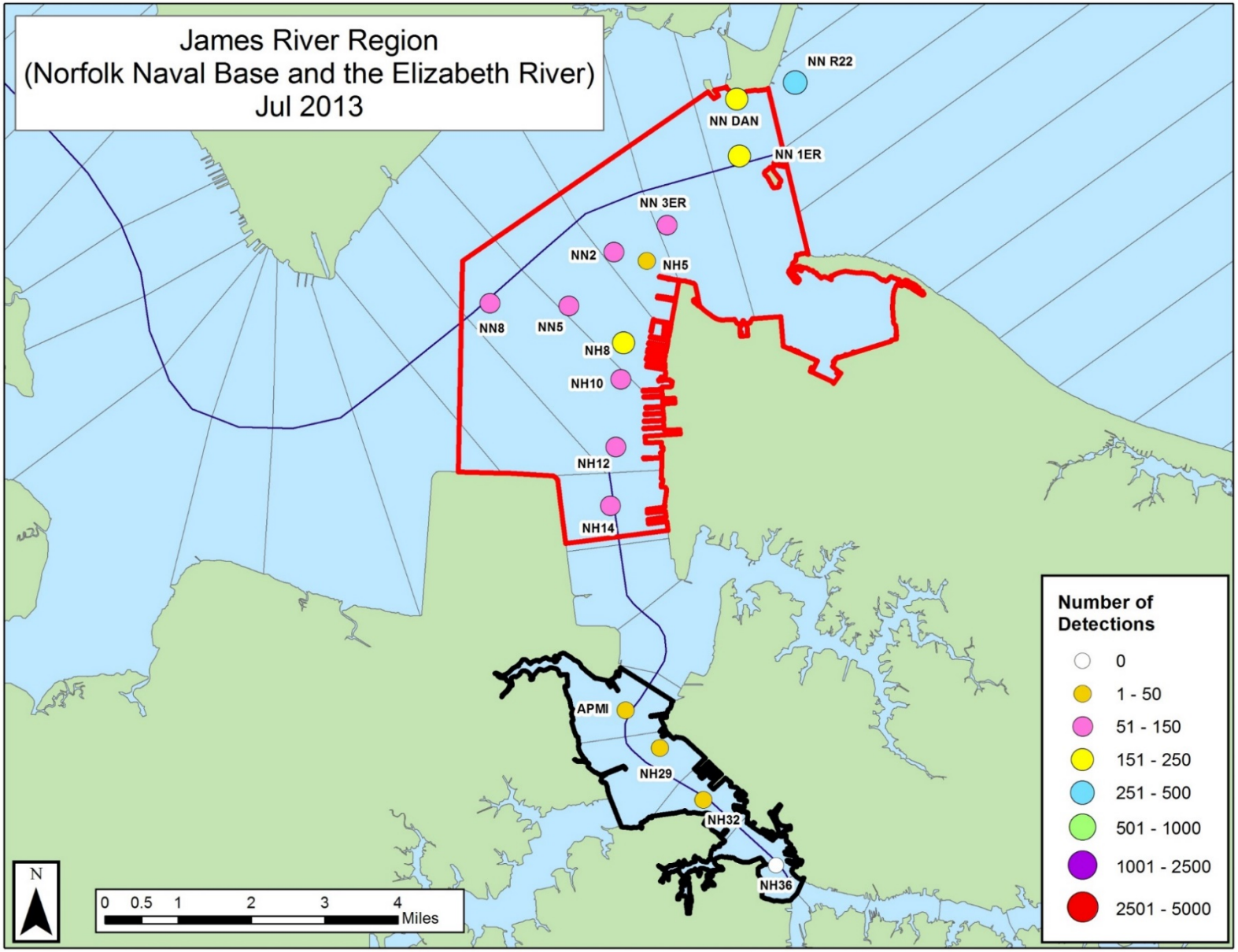

James River Region
(Norfolk Naval Base and the Elizabeth River)
Feb 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

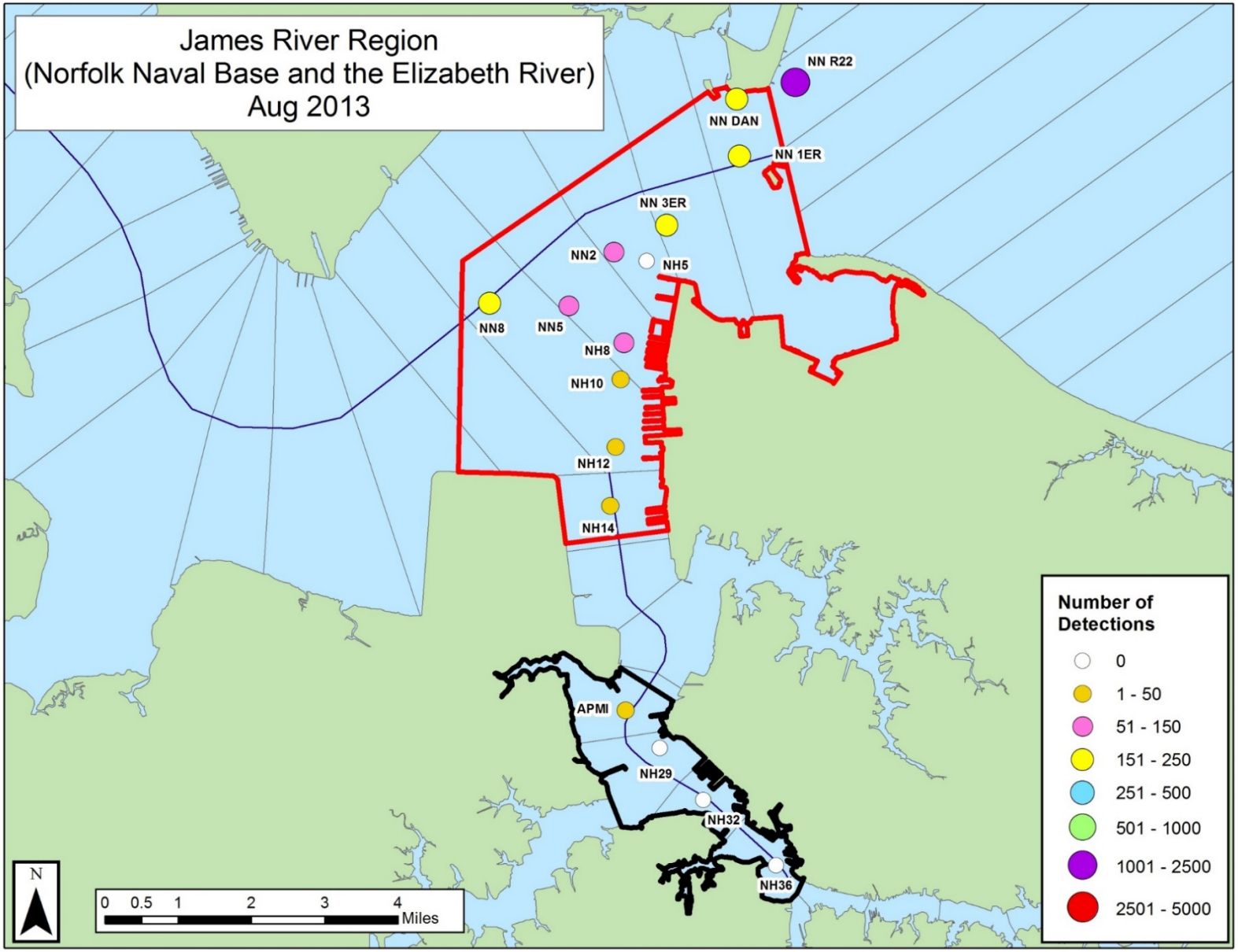

James River Region
(Norfolk Naval Base and the Elizabeth River)
Mar 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

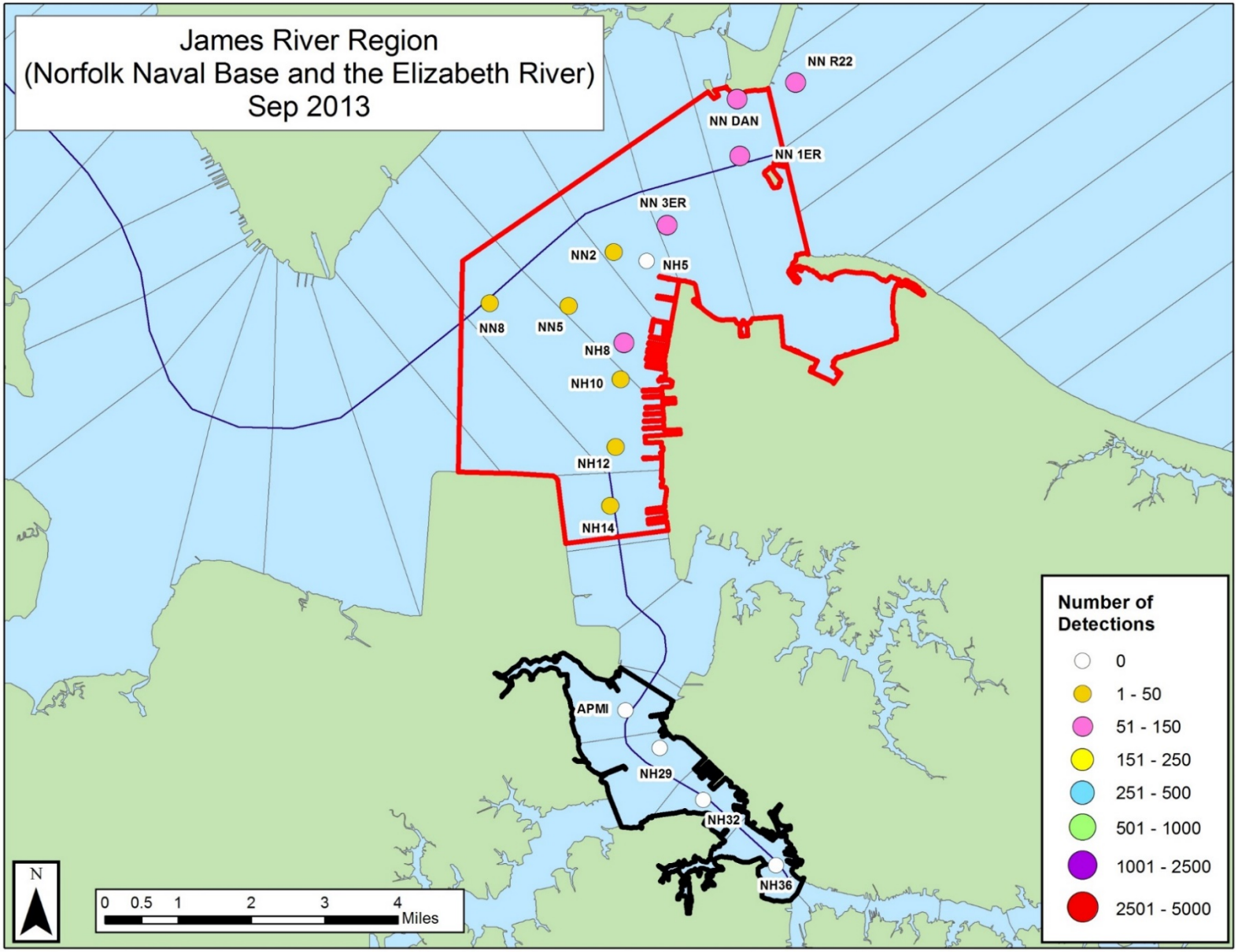

James River Region
(Norfolk Naval Base and the Elizabeth River)
Apr 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

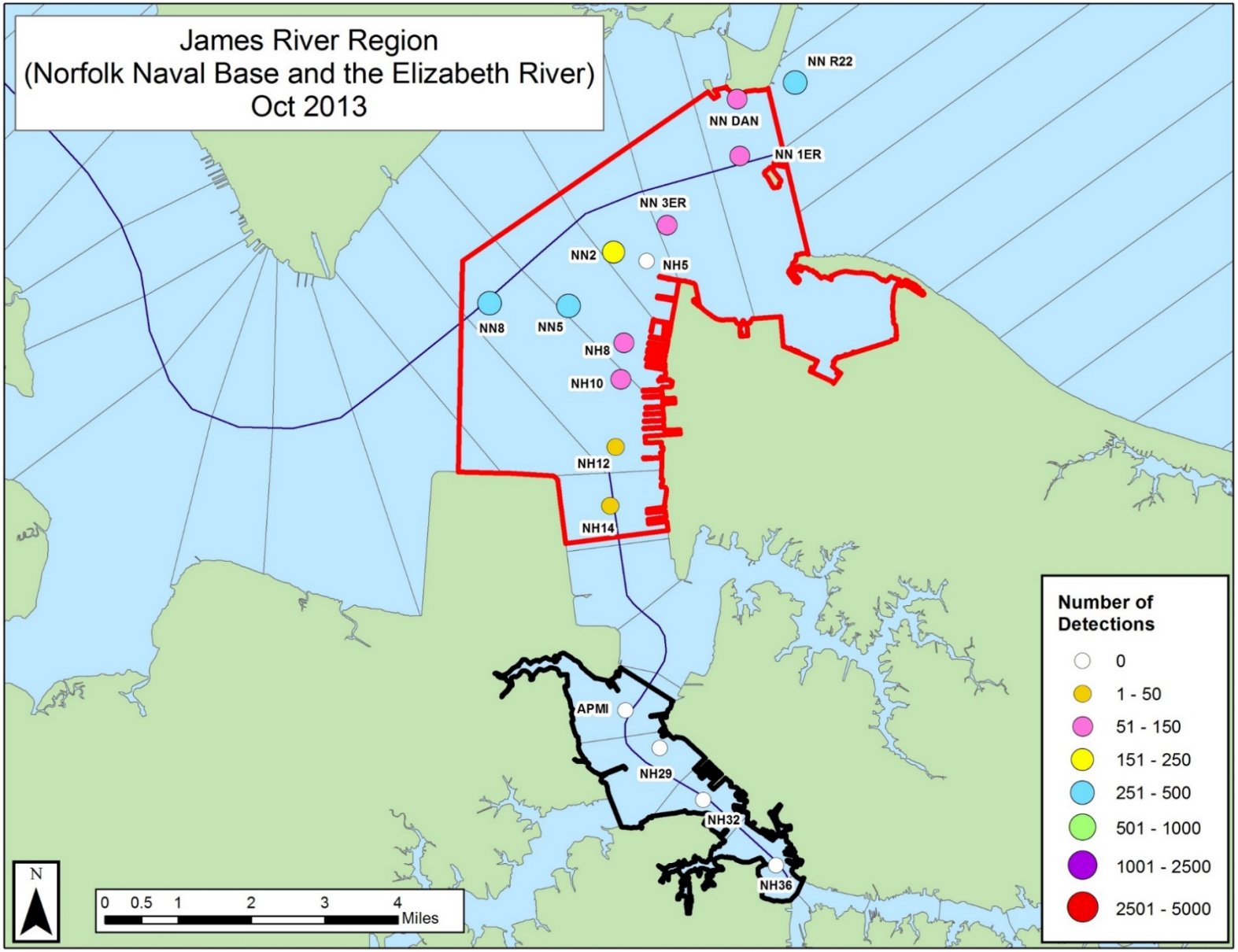

James River Region
(Norfolk Naval Base and the Elizabeth River)
May 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

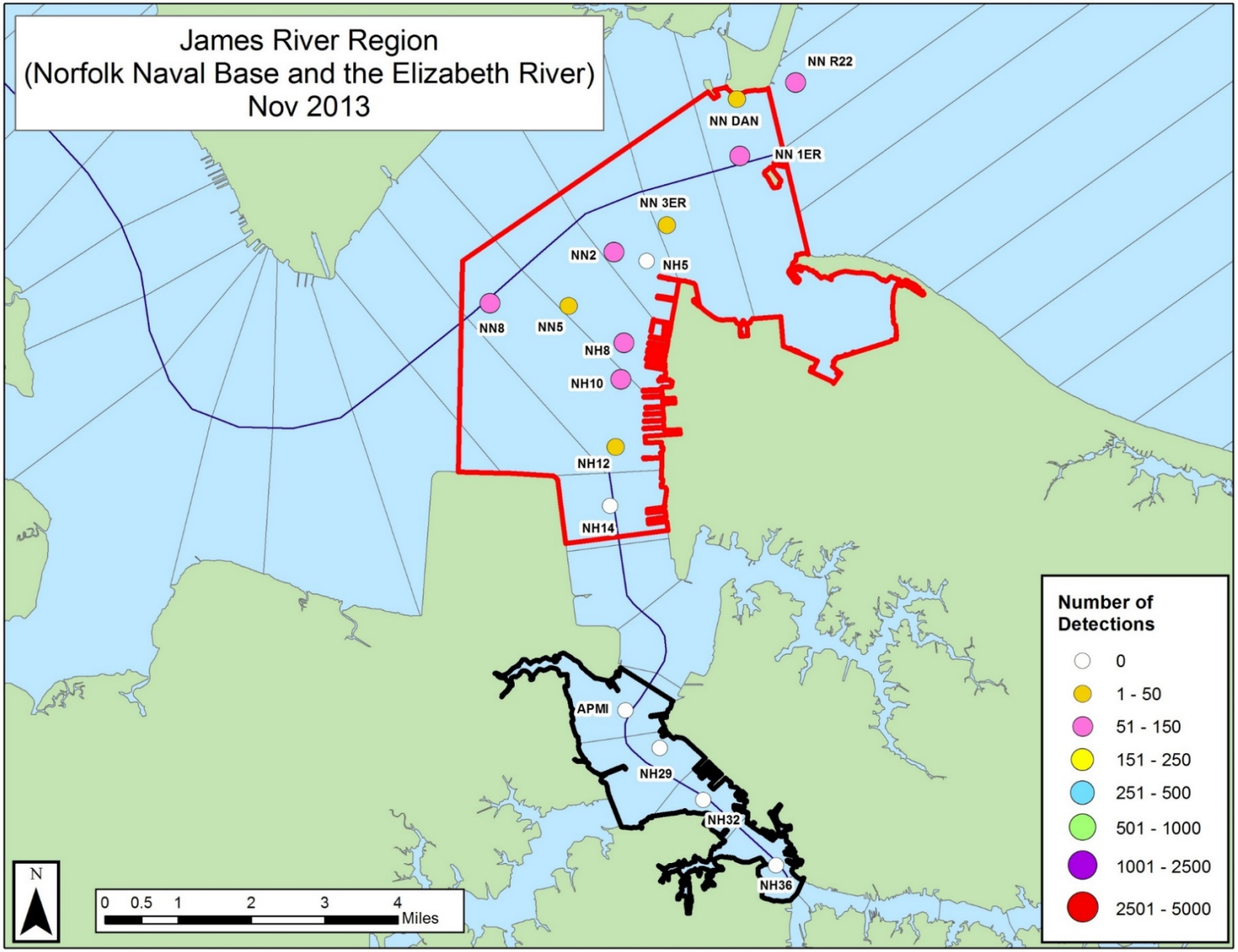

James River Region
(Norfolk Naval Base and the Elizabeth River)
Jun 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

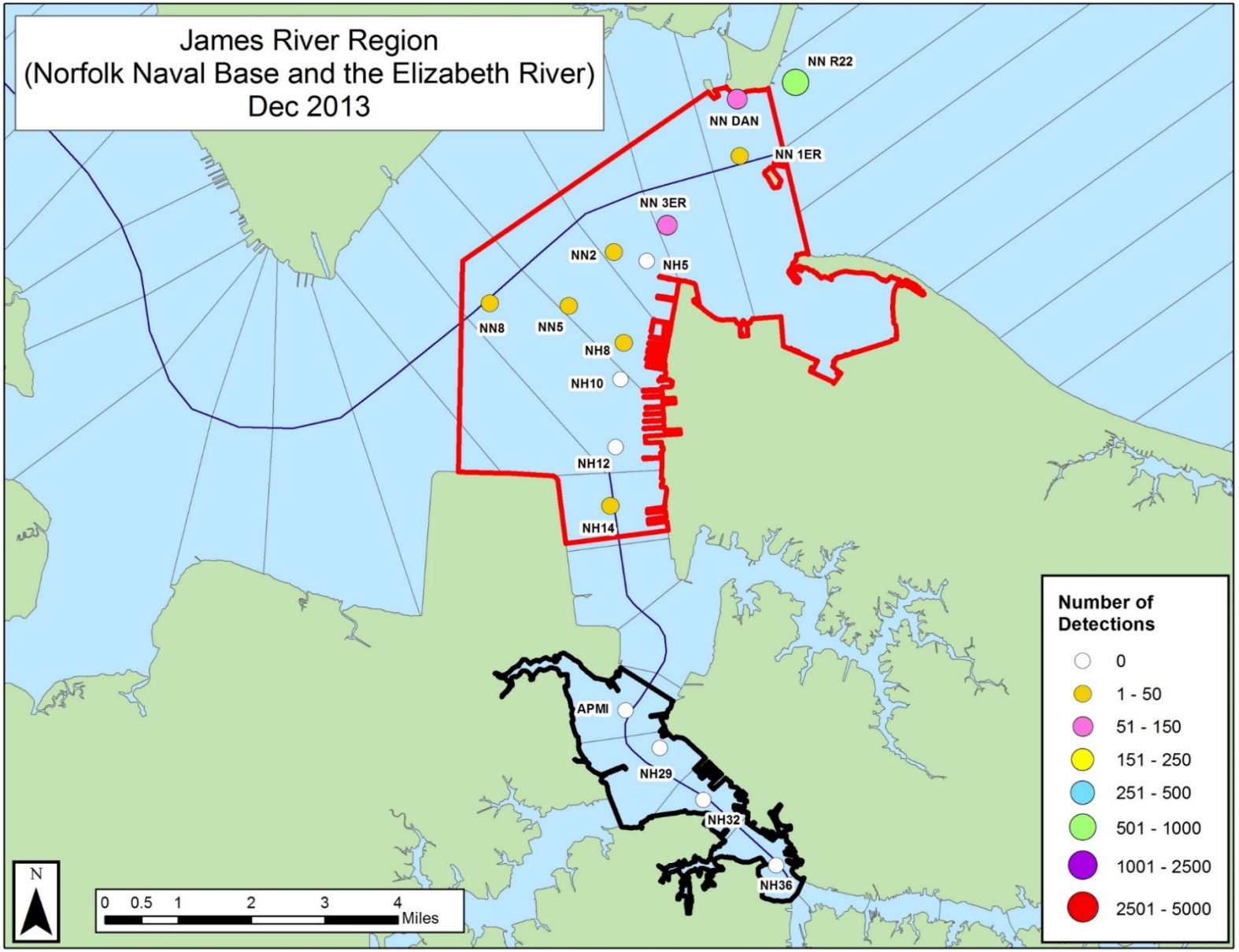

James River Region
(Norfolk Naval Base and the Elizabeth River)
Jul 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

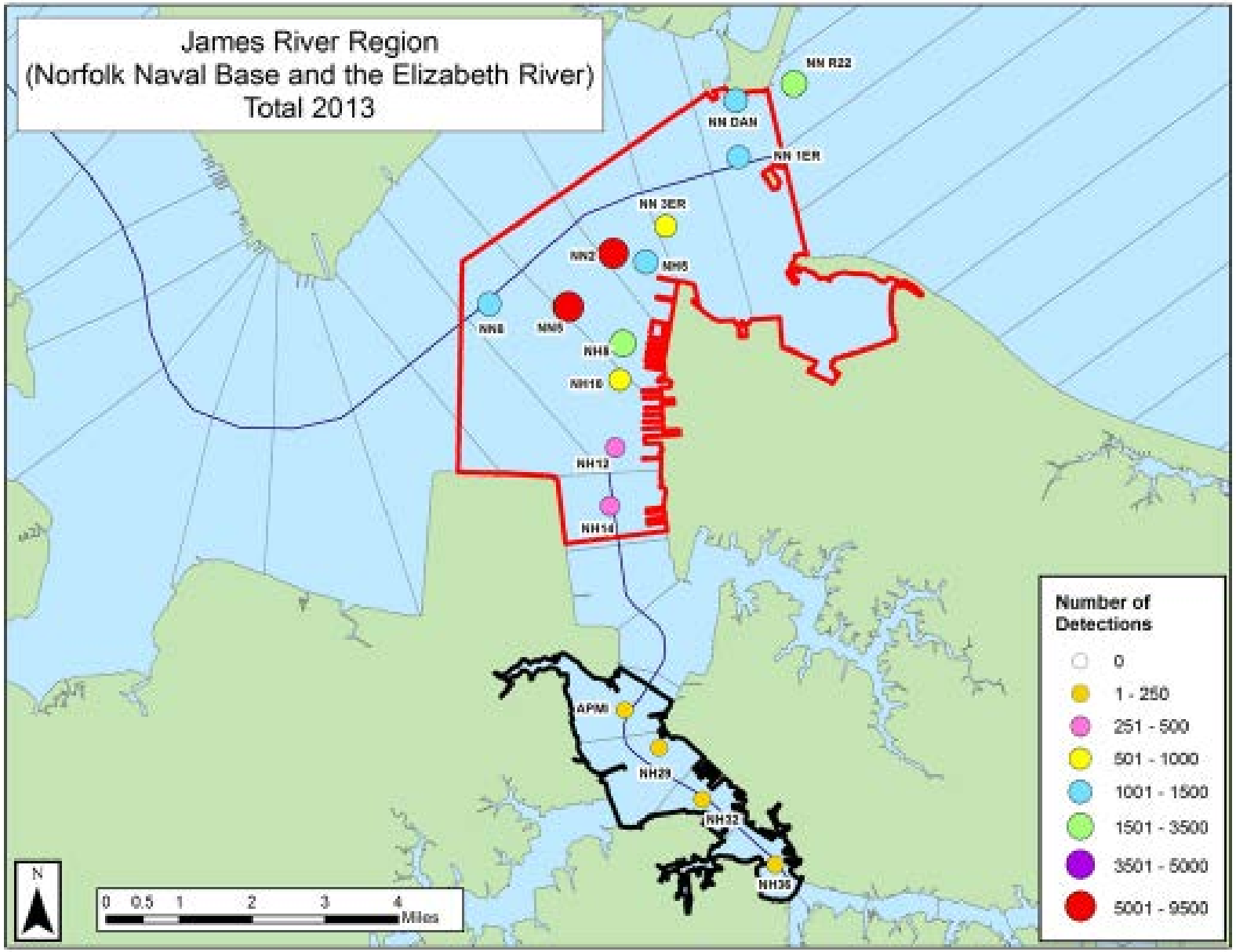

James River Region
(Norfolk Naval Base and the Elizabeth River)
Aug 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

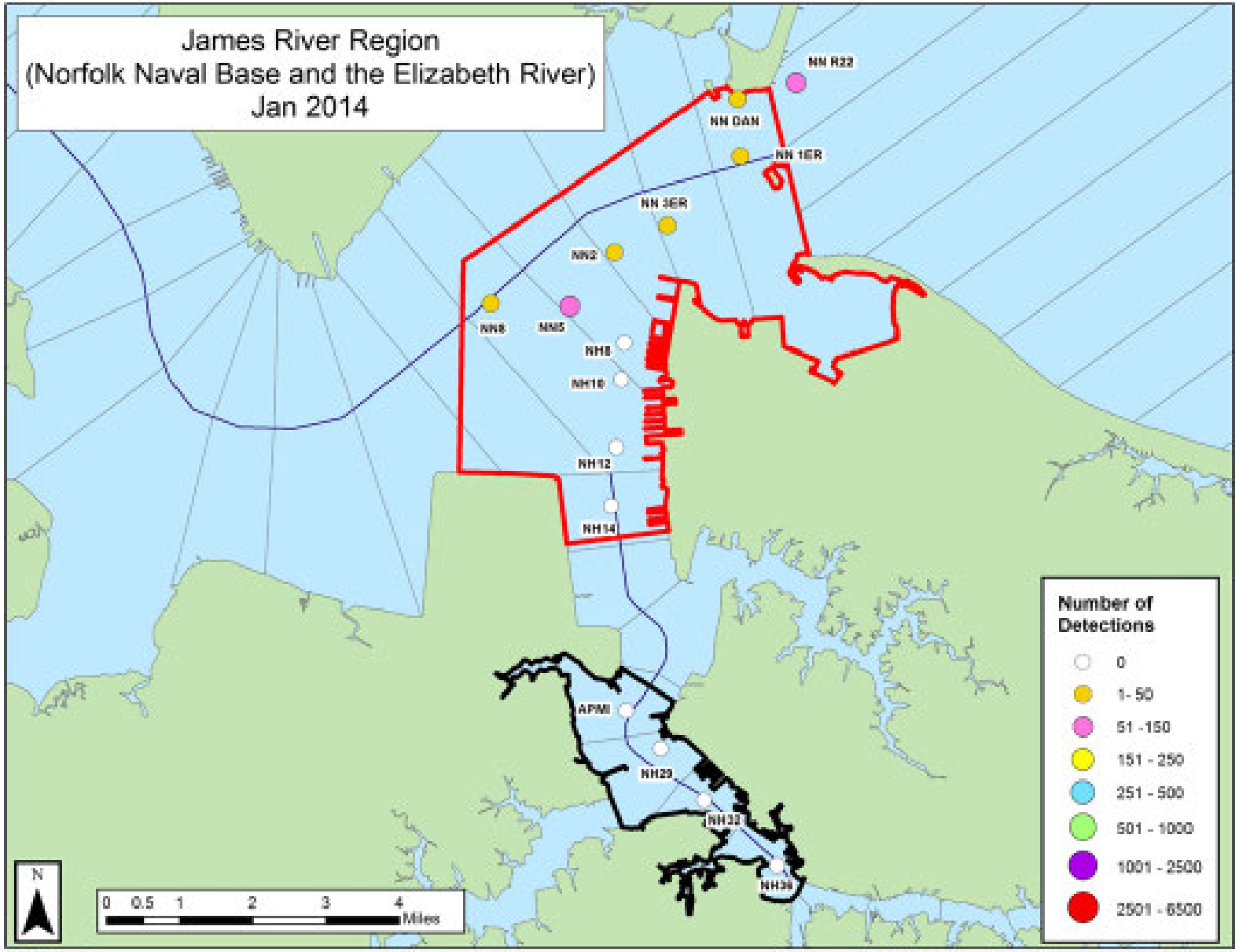

James River Region
(Norfolk Naval Base and the Elizabeth River)
Sep 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

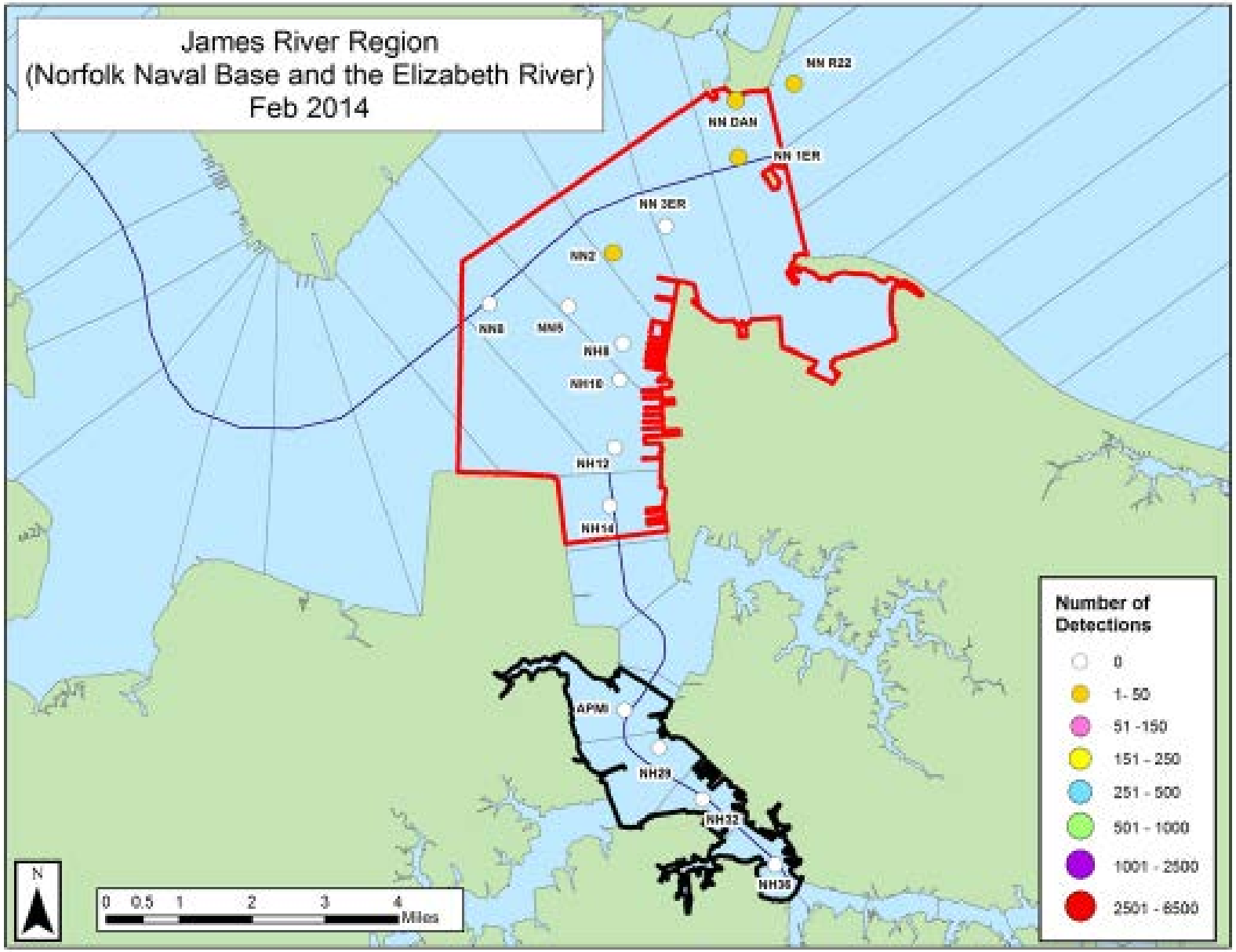

James River Region
(Norfolk Naval Base and the Elizabeth River)
Oct 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

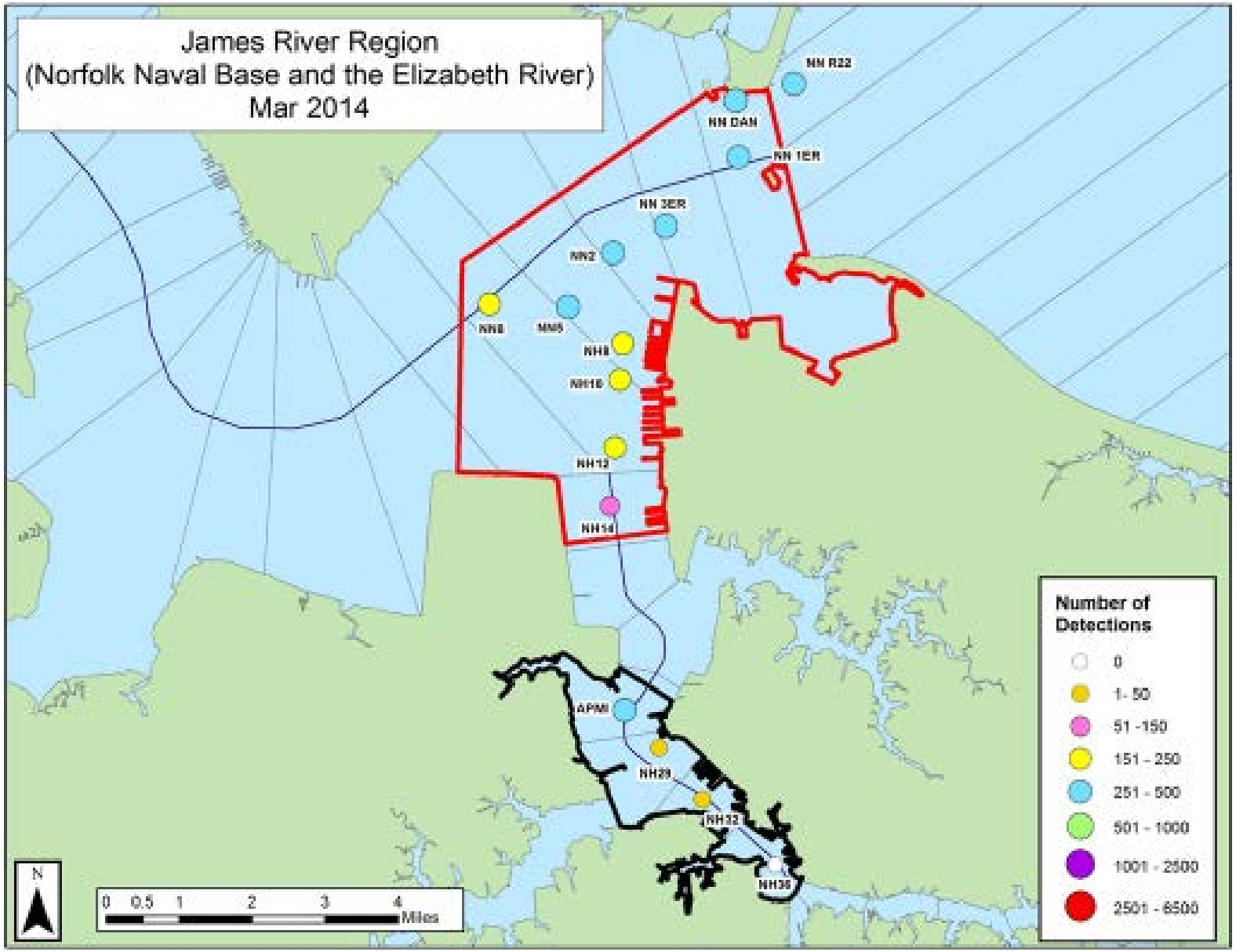

James River Region
(Norfolk Naval Base and the Elizabeth River)
Nov 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

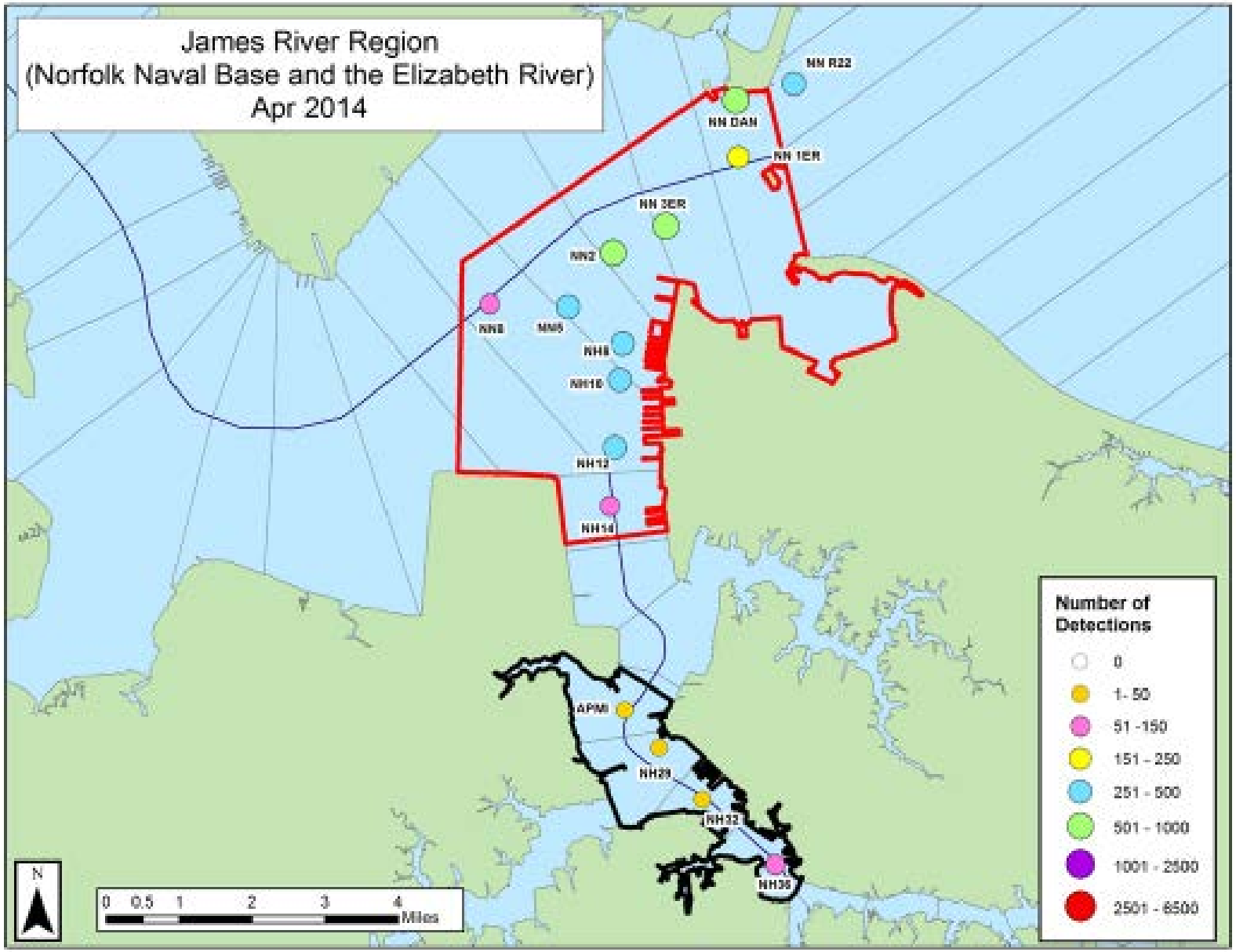

James River Region
(Norfolk Naval Base and the Elizabeth River)
Dec 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NH5
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH36
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

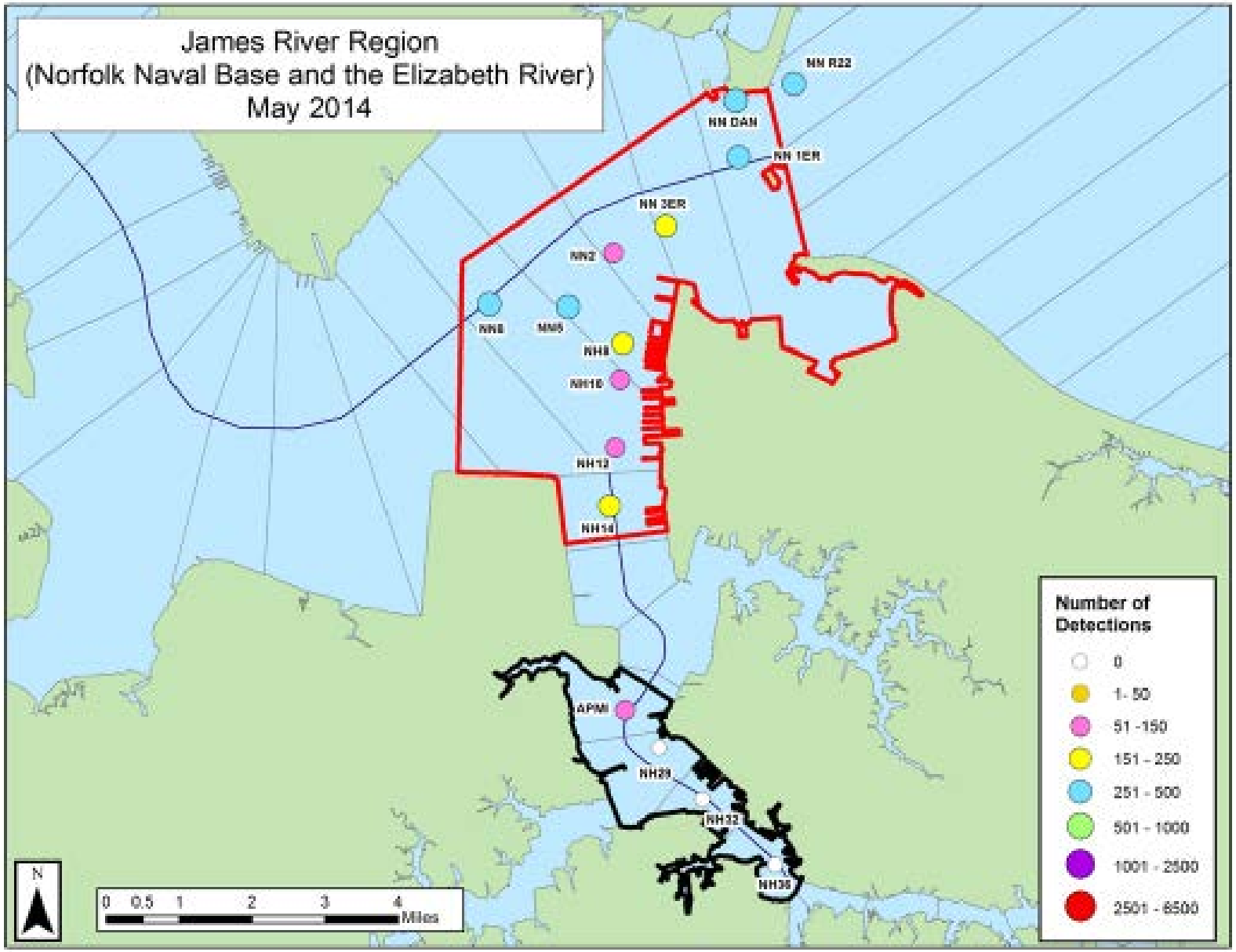

James River Region
(Norfolk Naval Base and the Elizabeth River)
Total 2013
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
MM5
NN8
MM5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH38
Number of Detections
0
1 - 250
251 - 500
501 - 1000
1001 - 1500
1501 - 3500
3501 - 5000
5001 - 9500
N
0 0.5 1 2 3 4
Miles

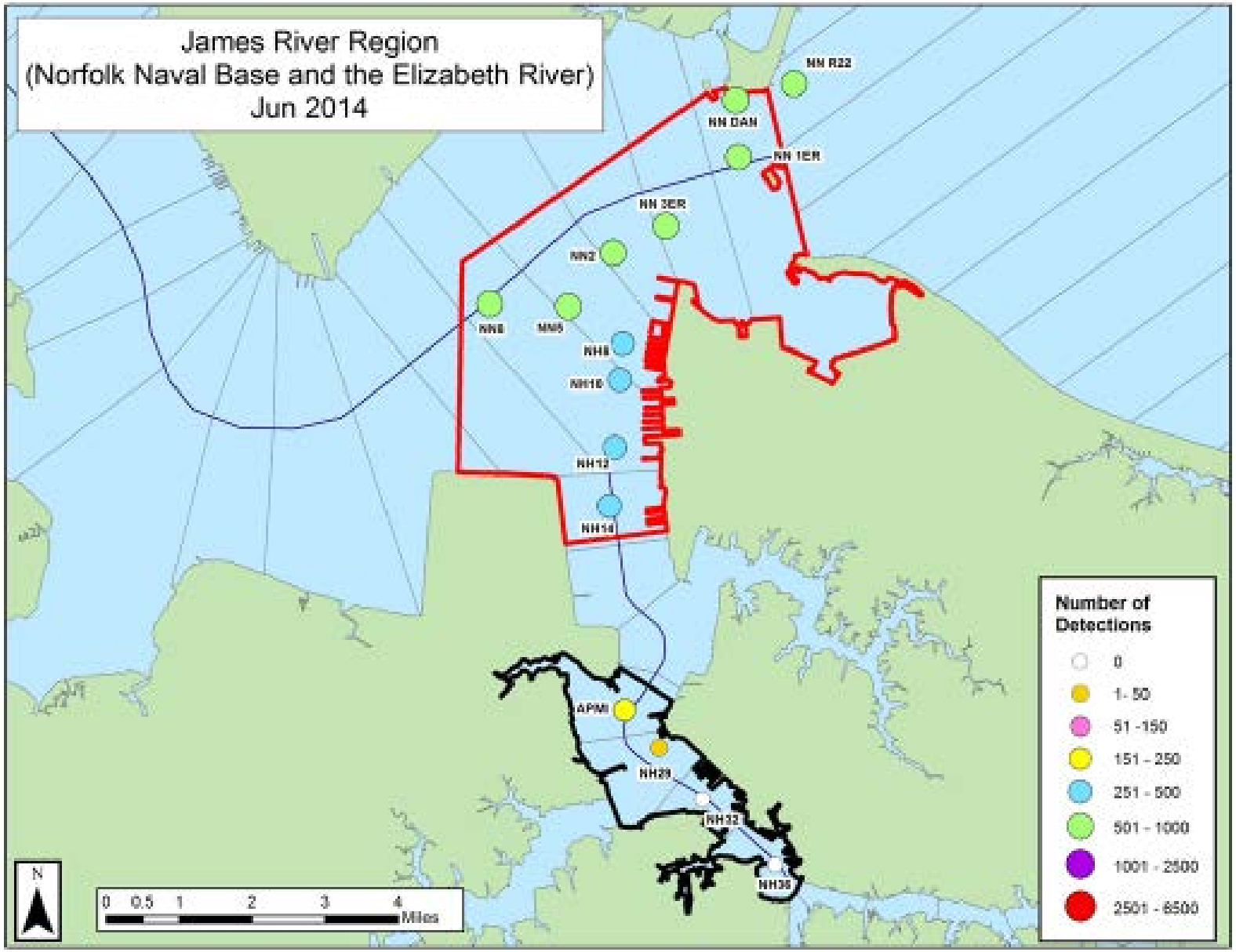

James River Region
(Norfolk Naval Base and the Elizabeth River)
Jan 2014
NN R22
NN OAH
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APM
NH23
NH33
NH36
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

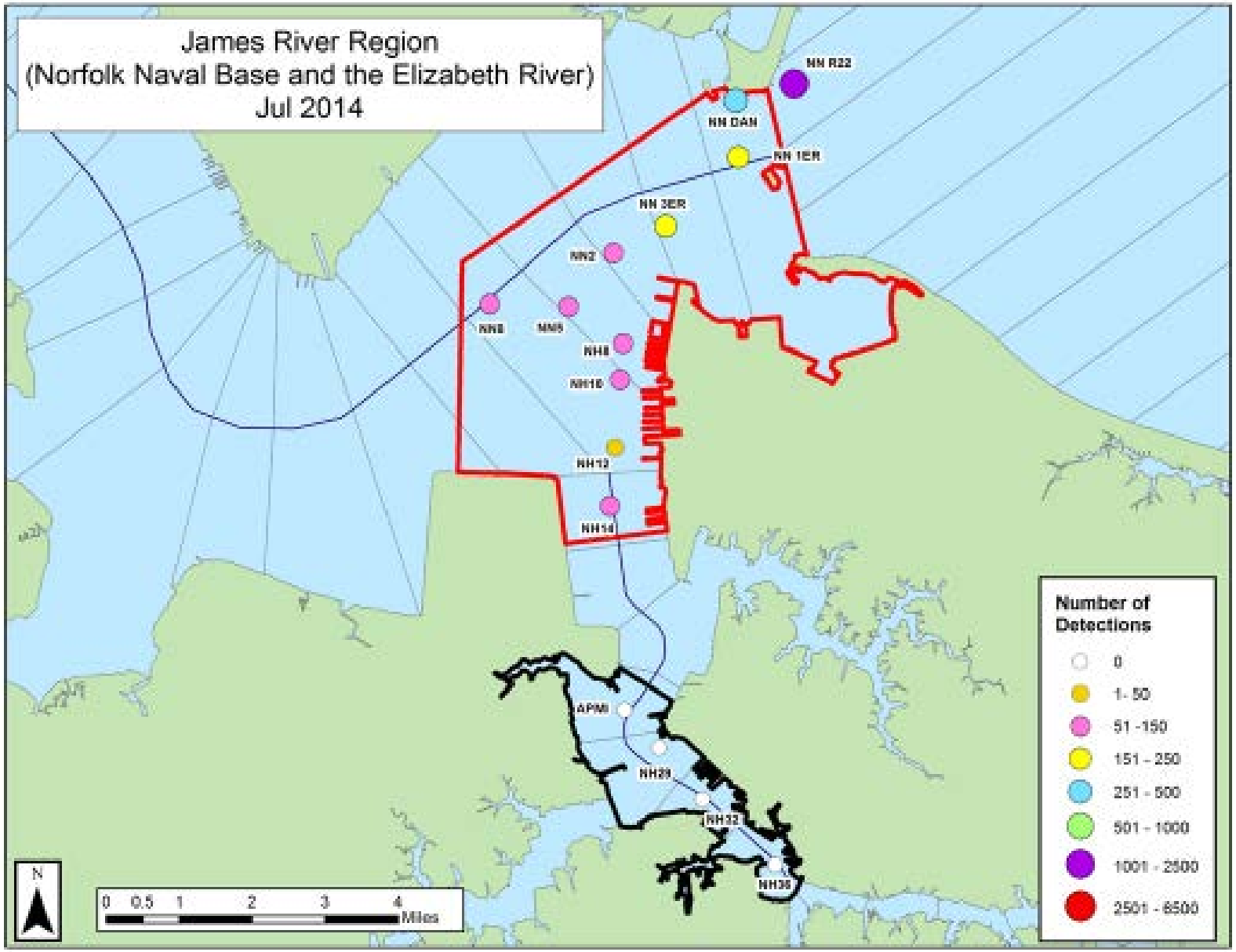

James River Region
(Norfolk Naval Base and the Elizabeth River)
Feb 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH30
N
0 0.5 1 2 3 4
Miles
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500

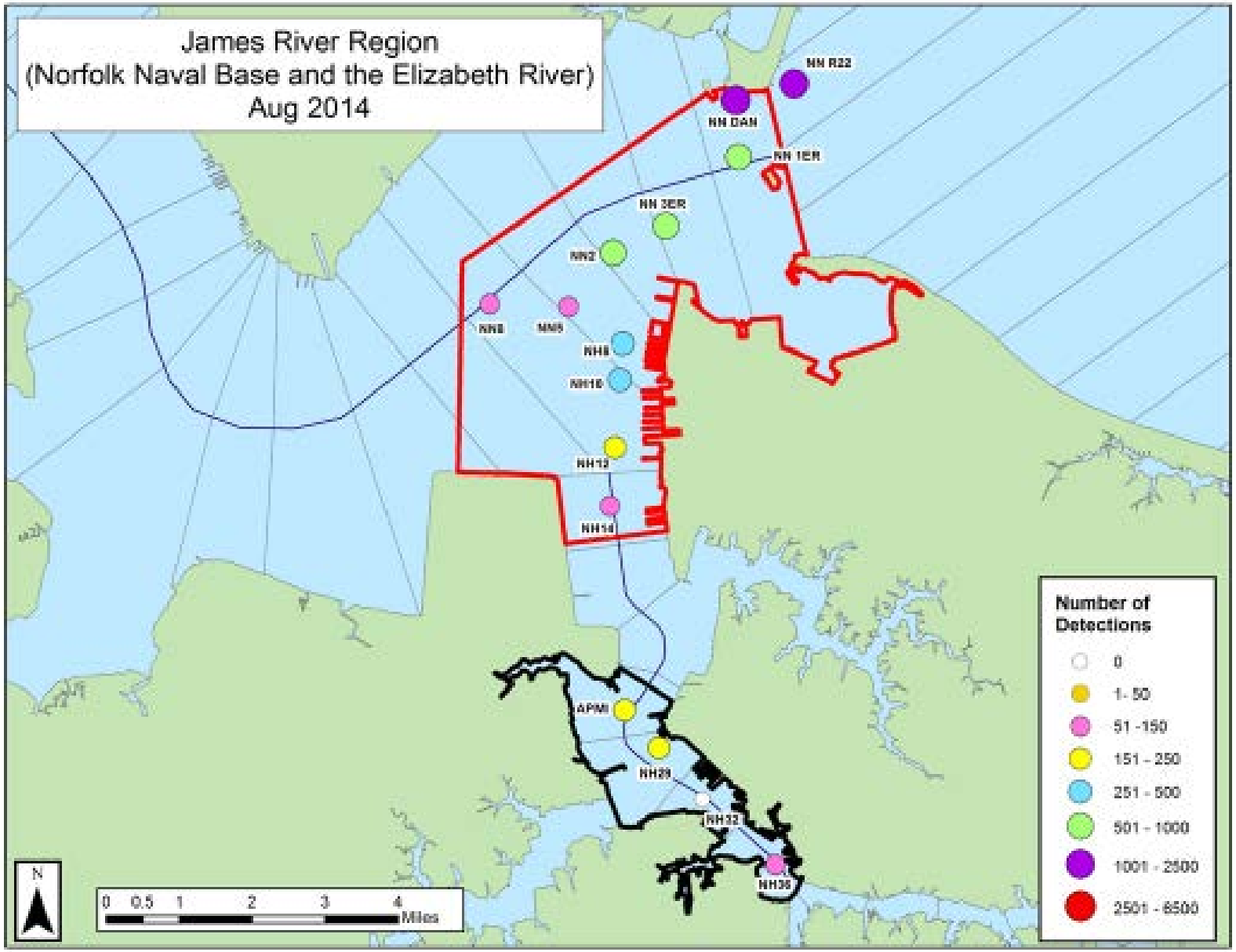

James River Region
(Norfolk Naval Base and the Elizabeth River)
Mar 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APM
NH29
NH32
NH30
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

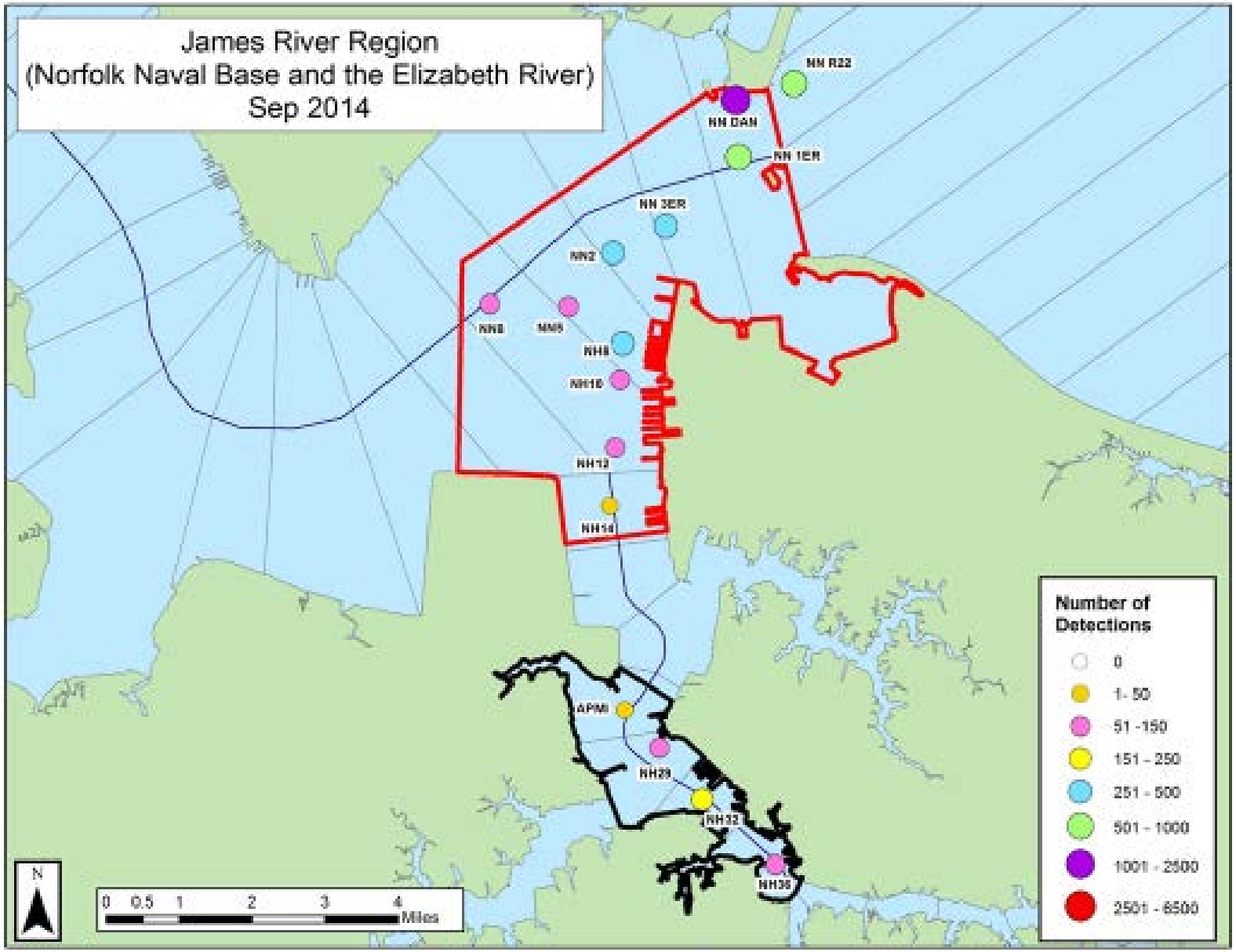

James River Region
(Norfolk Naval Base and the Elizabeth River)
Apr 2014
NN R22
NN OAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH38
N
0 0.5 1 2 3 4
Miles
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500

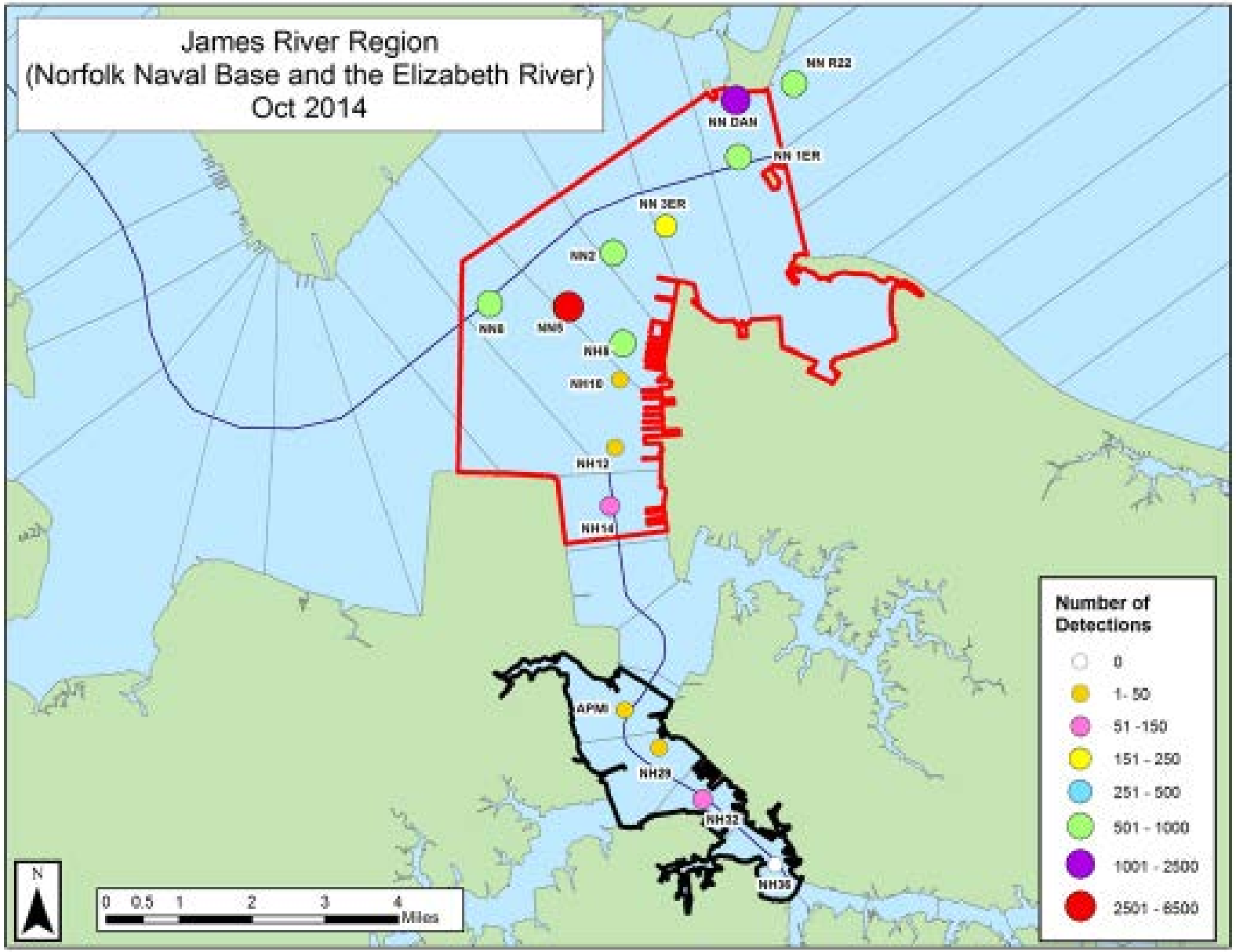

James River Region
(Norfolk Naval Base and the Elizabeth River)
May 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APM
NH29
NH32
NH30
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

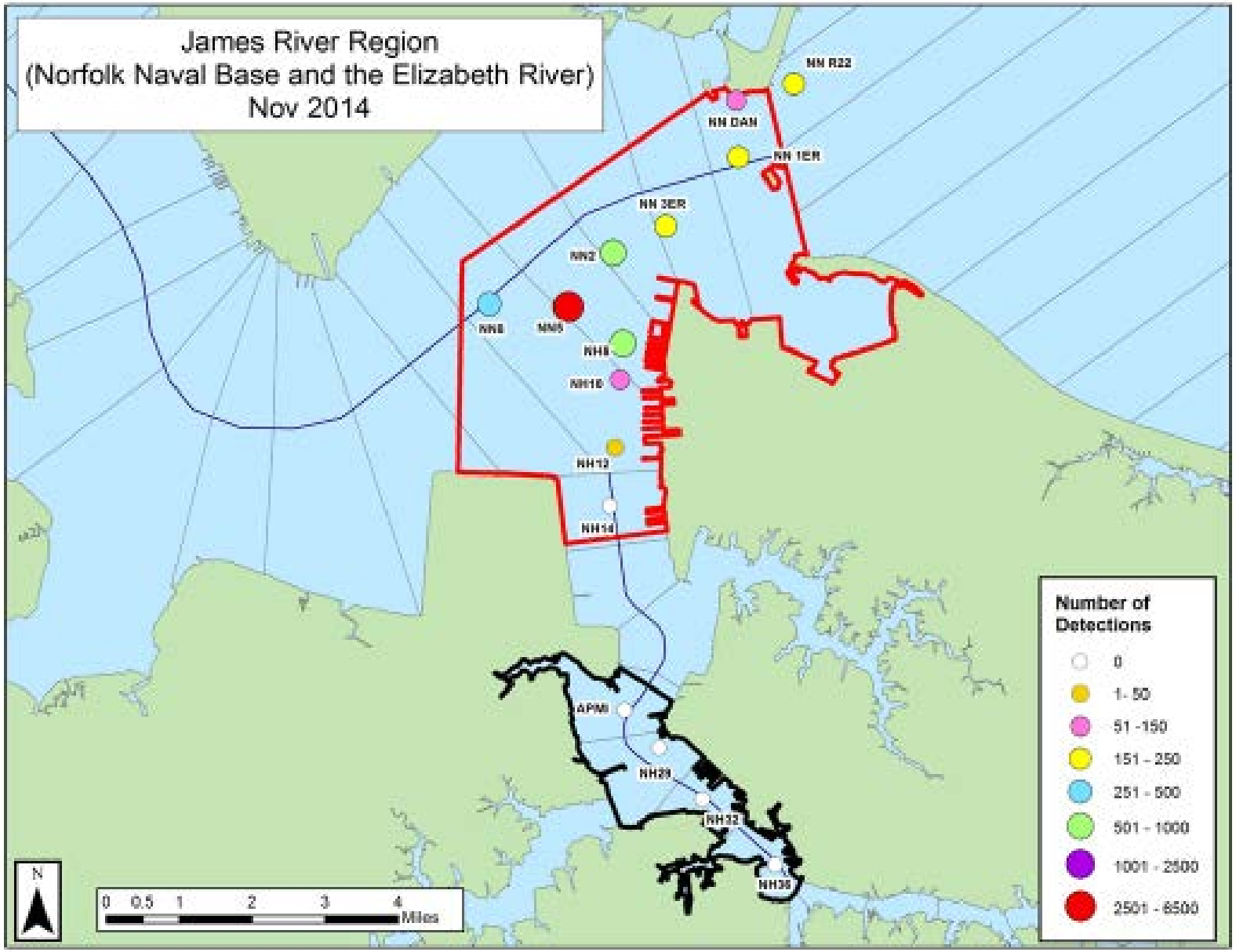

James River Region
(Norfolk Naval Base and the Elizabeth River)
Jun 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APM
NH29
NH32
NH30
N
0 0.5 1 2 3 4
Miles
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500

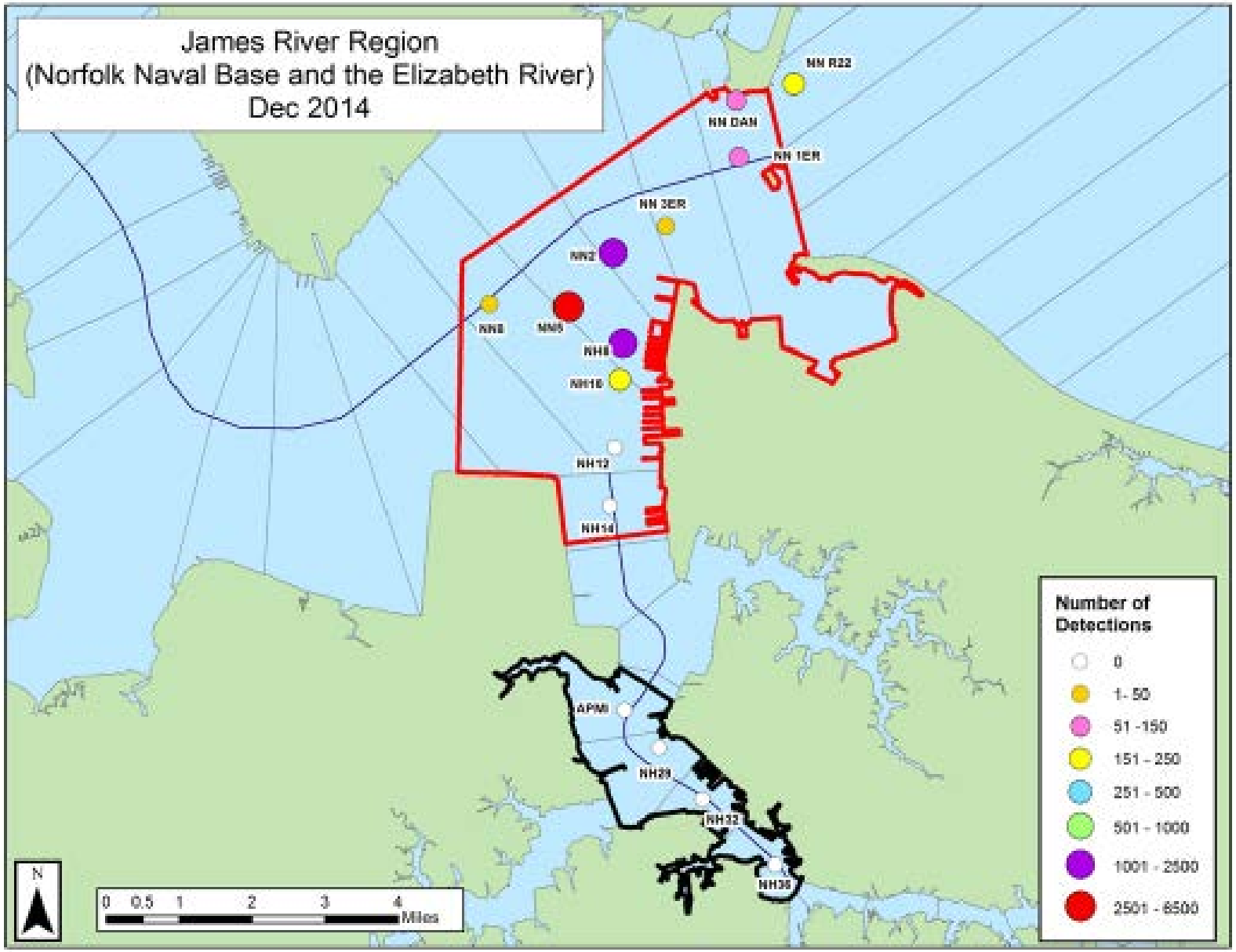

James River Region
(Norfolk Naval Base and the Elizabeth River)
Jul 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NN6
NN10
NH13
NH14
APM
NH29
NH32
NH30
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

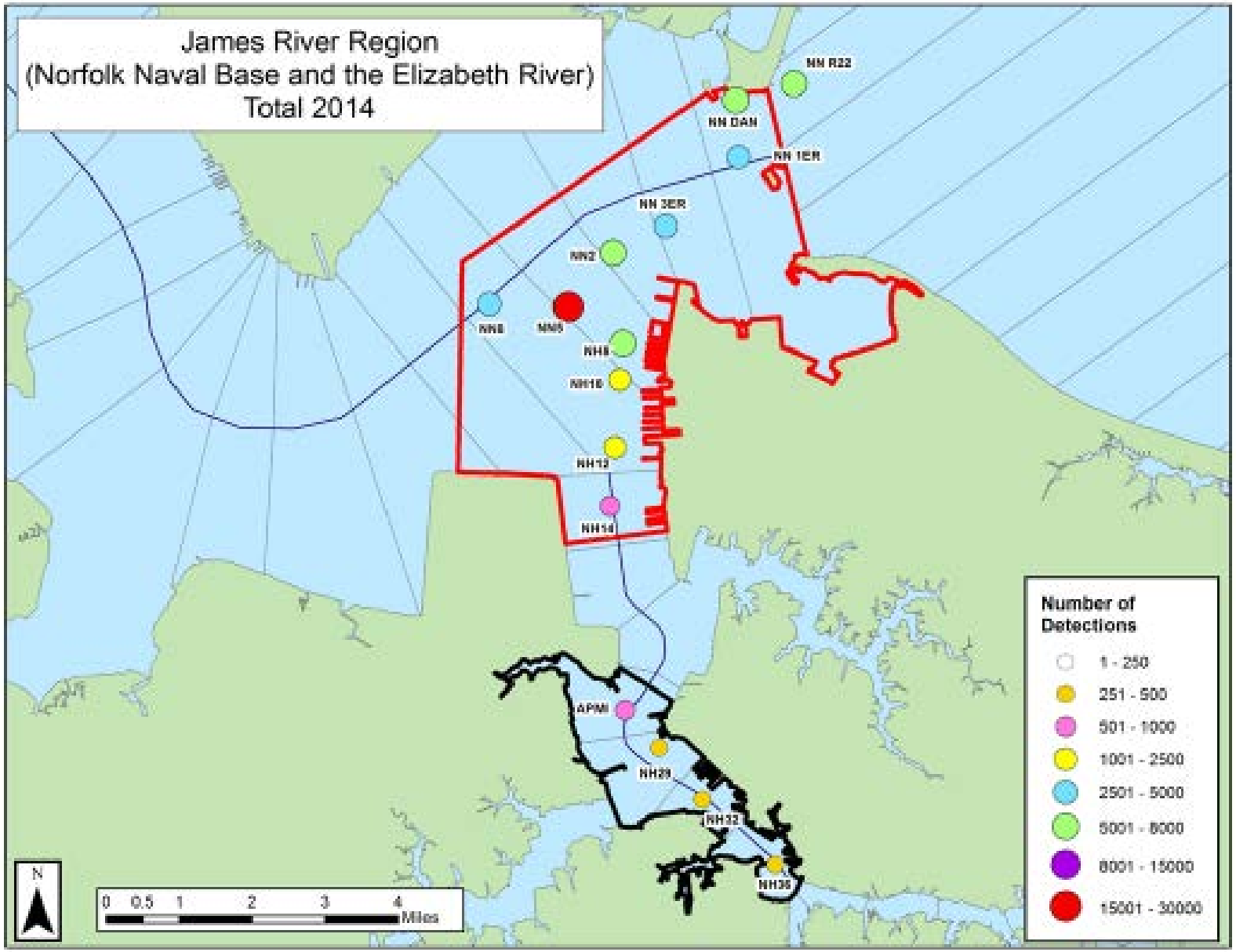

James River Region
(Norfolk Naval Base and the Elizabeth River)
Aug 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APM
NH29
NH32
NH30
N
0 0.5 1 2 3 4
Miles
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500

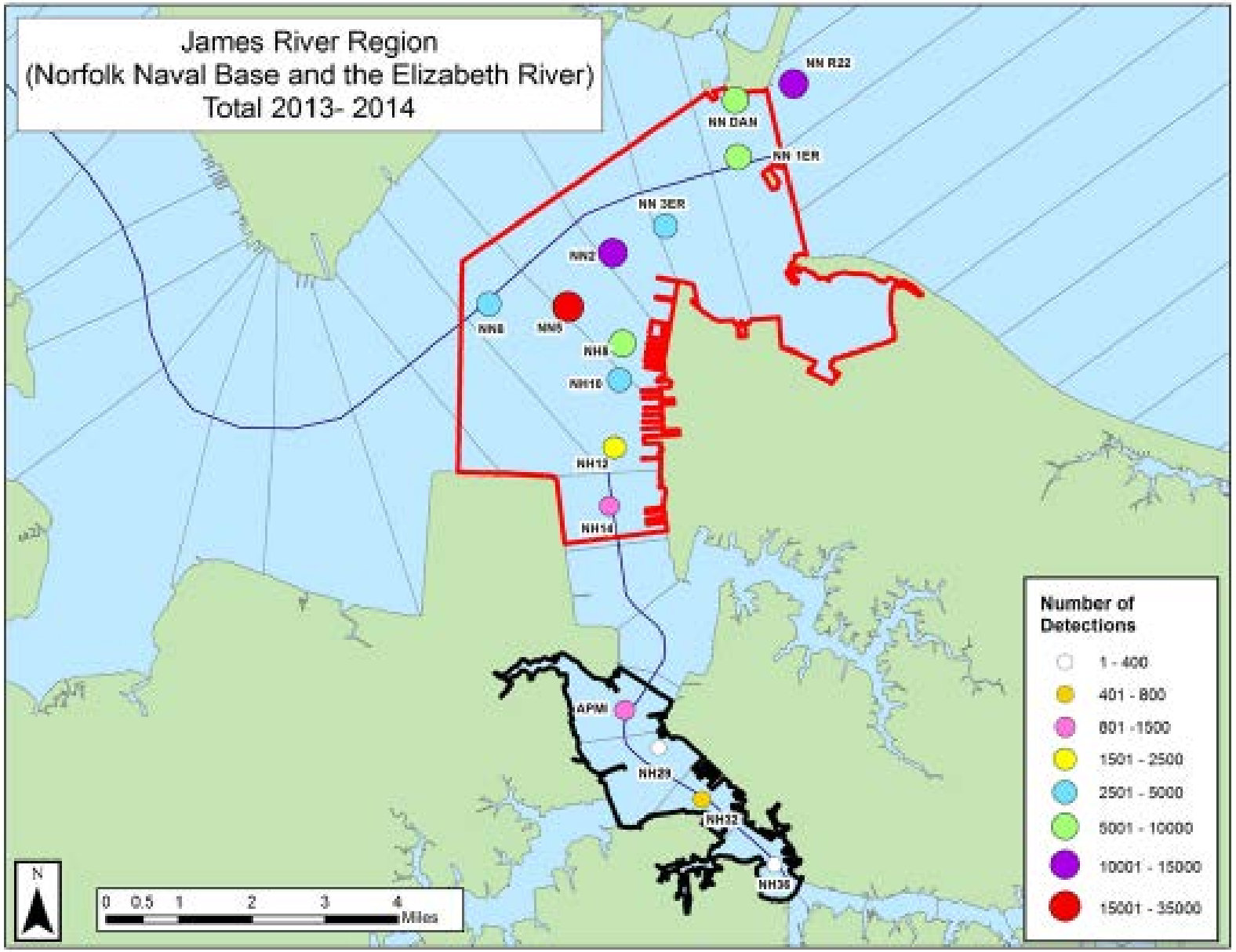

James River Region
(Norfolk Naval Base and the Elizabeth River)
Sep 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APM
NH29
NH32
NH38
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles


James River Region
(Norfolk Naval Base and the Elizabeth River)
Oct 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APM
NH29
NH32
NH30
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

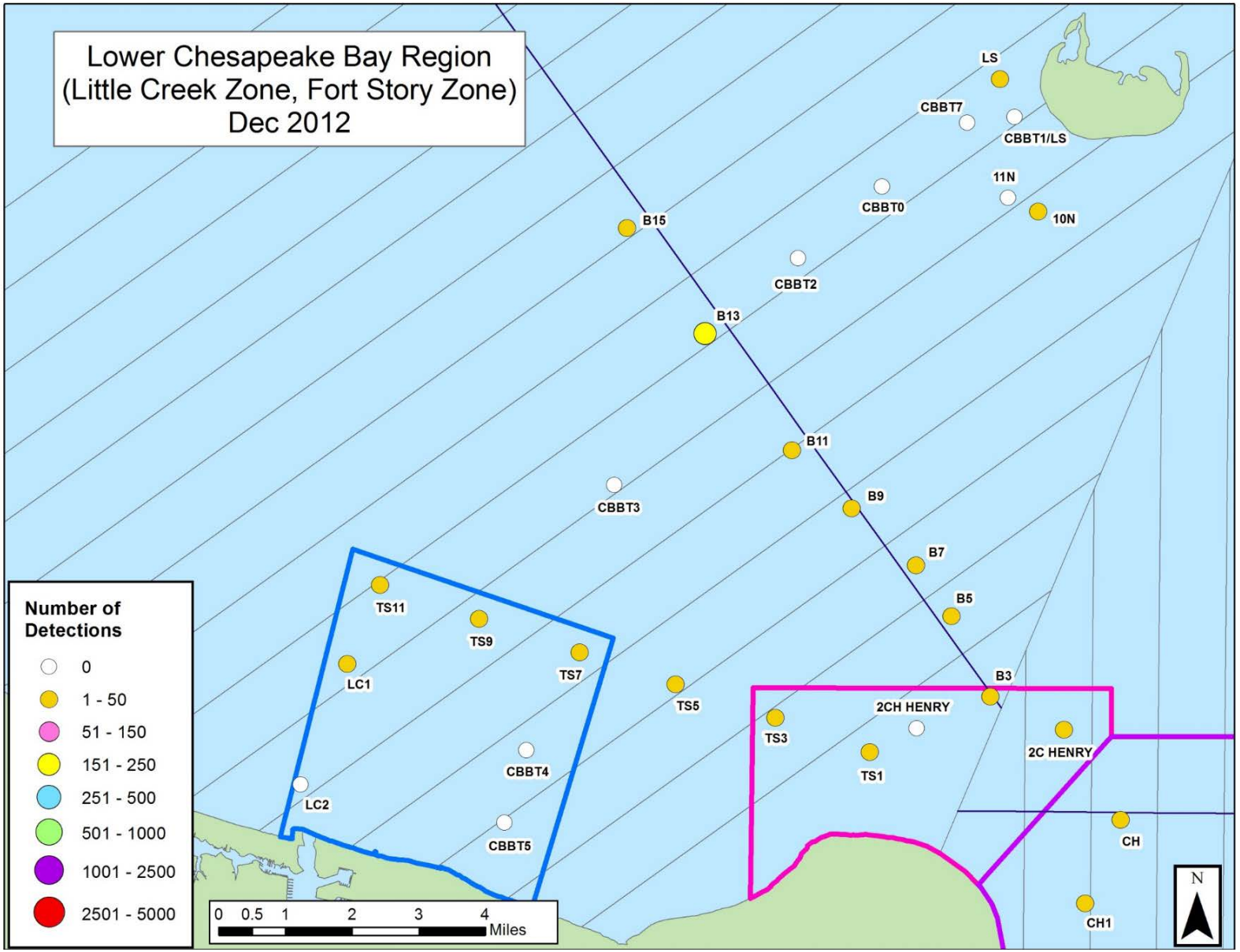

James River Region
(Norfolk Naval Base and the Elizabeth River)
Nov 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APM
NH29
NH32
NH30
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

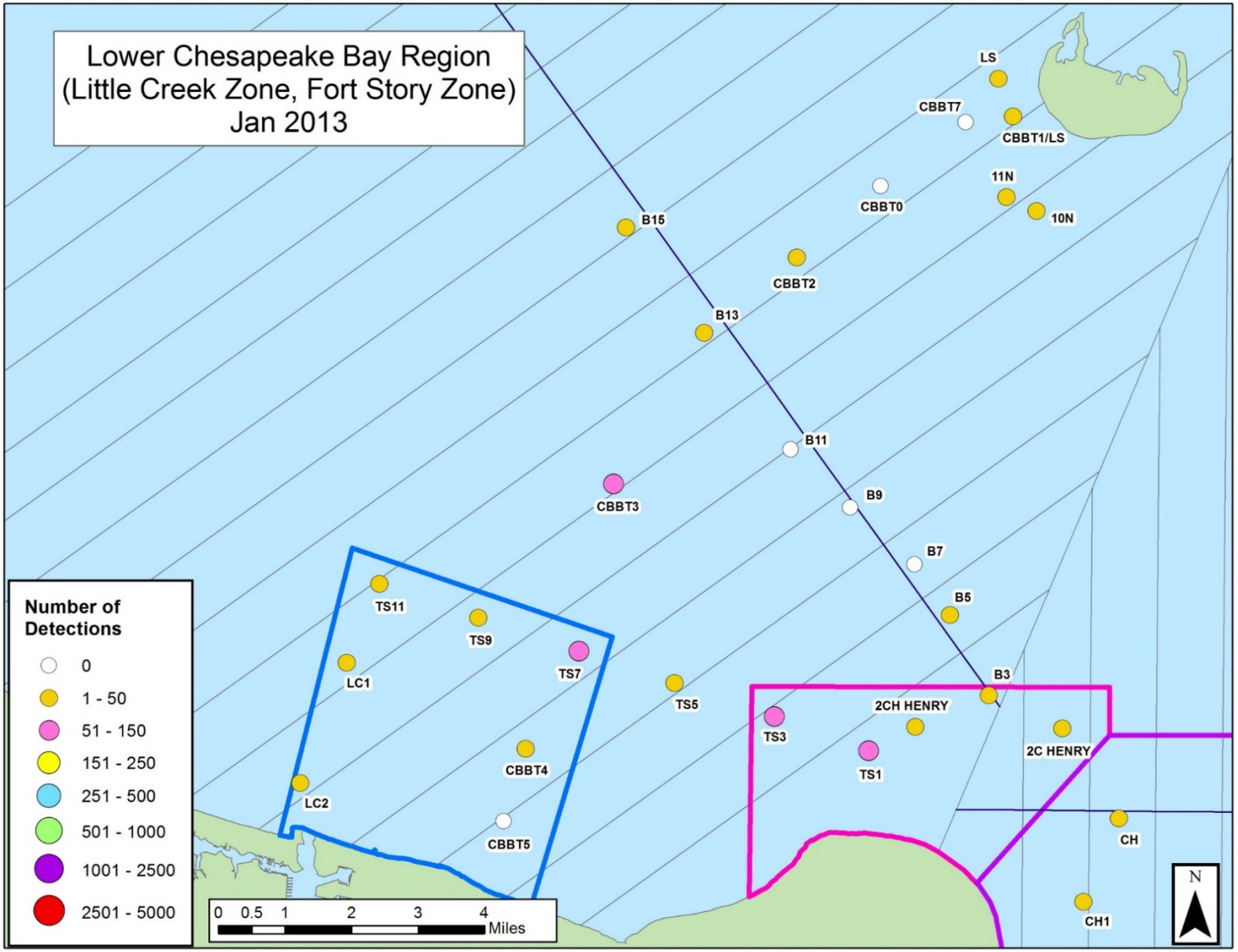

James River Region
(Norfolk Naval Base and the Elizabeth River)
Dec 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APMI
NH29
NH32
NH30
N
0 0.5 1 2 3 4
Miles
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500

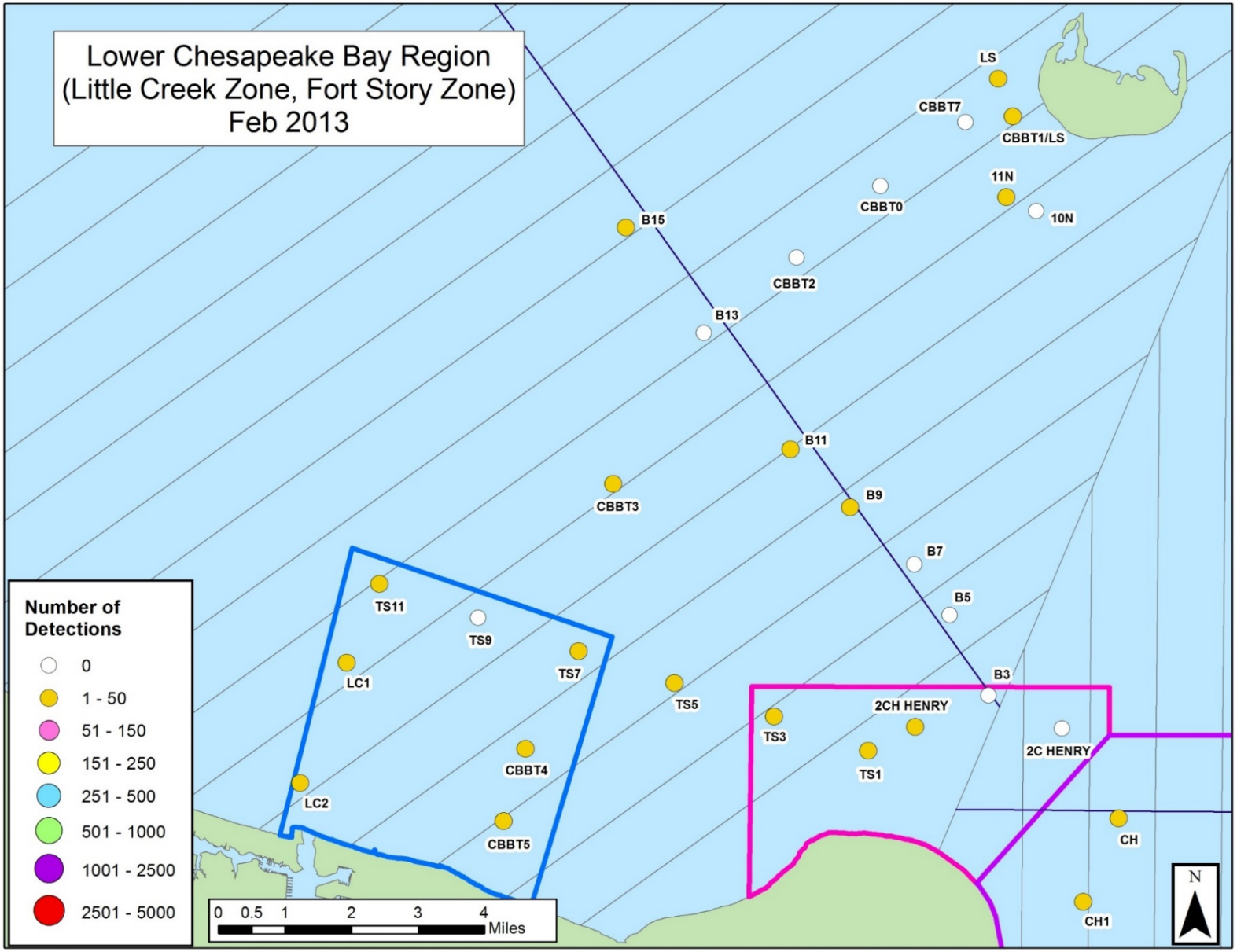

James River Region
(Norfolk Naval Base and the Elizabeth River)
Total 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH8
NH10
NH12
NH14
APM
NH29
NH32
NH30
Number of Detections
1 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
5001 - 8000
8001 - 15000
15001 - 30000
N
0 0.5 1 2 3 4
Miles

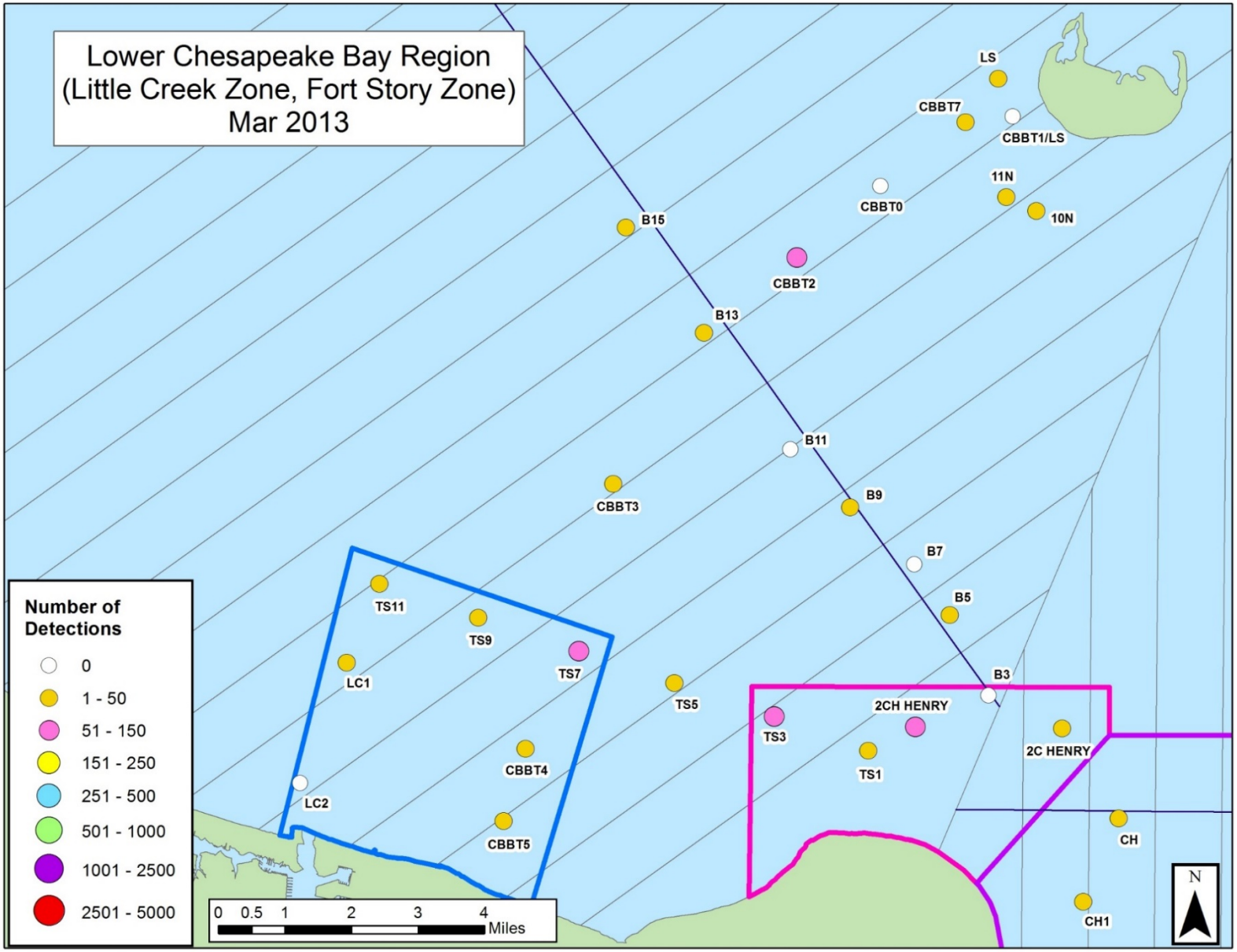

James River Region
(Norfolk Naval Base and the Elizabeth River)
Total 2013- 2014
NN R22
NN DAN
NN 1ER
NN 3ER
NN2
NN8
NN5
NH6
NH10
NH12
NH14
APM
NH29
NH32
NH38
Number of Detections
1 - 400
401 - 800
801 -1500
1501 - 2500
2501 - 5000
5001 - 10000
10001 - 15000
15001 - 35000
N
0 0.5 1 2 3 4
Miles

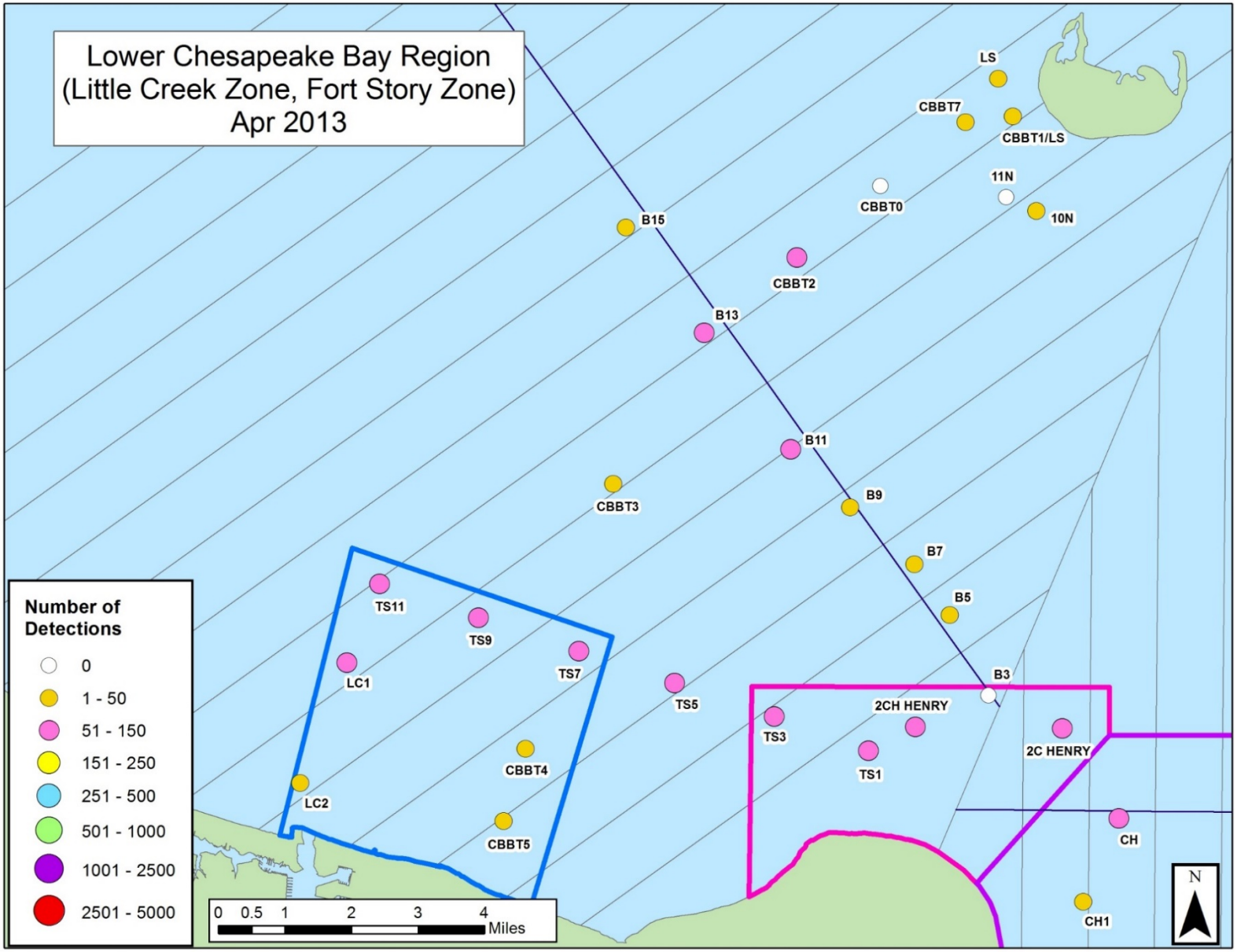
9.7 APPENDIX 4.4.5: LOWER CHESAPEAKE BAY REGION (LITTLE CREEK ZONE, FORT STORY ZONE)

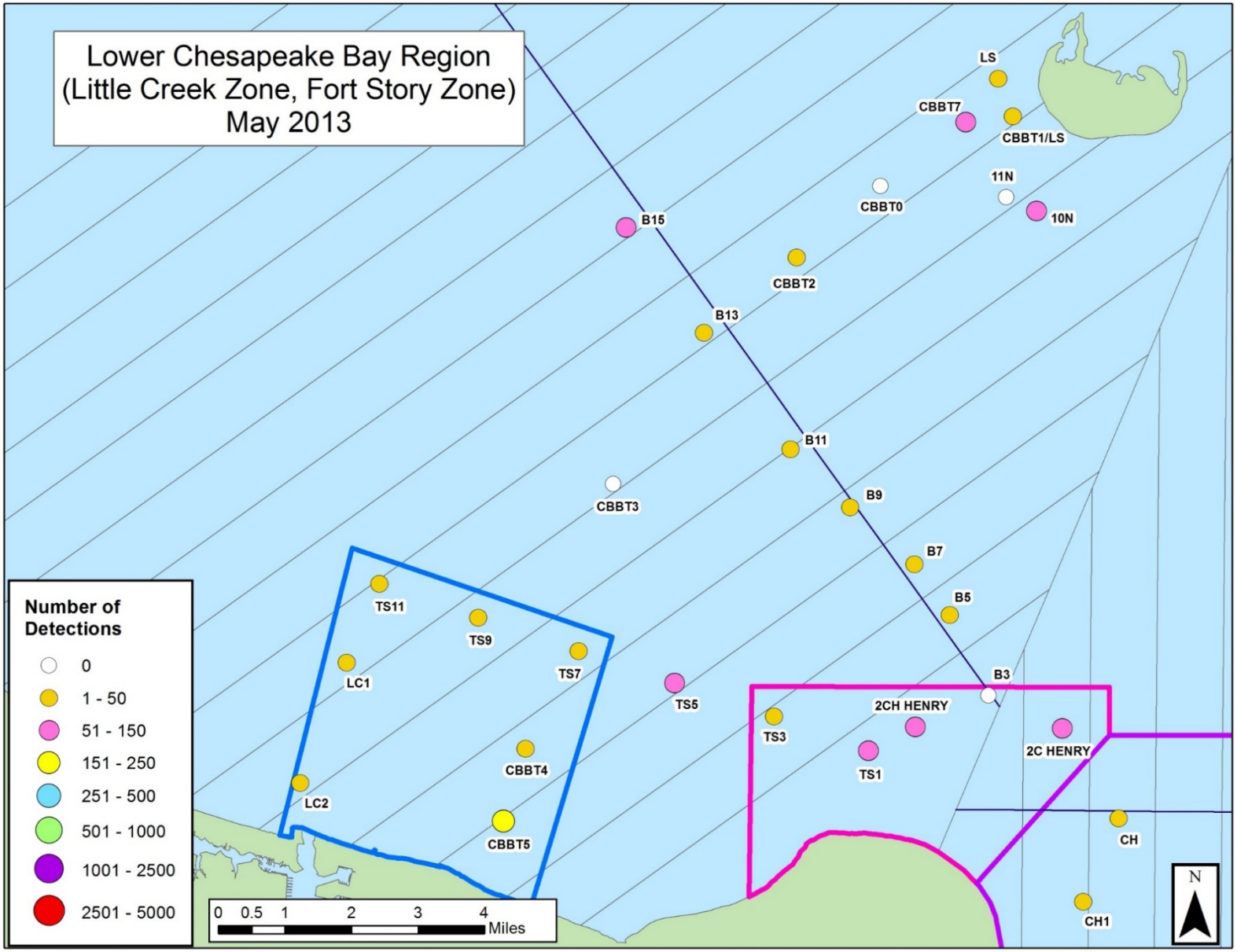


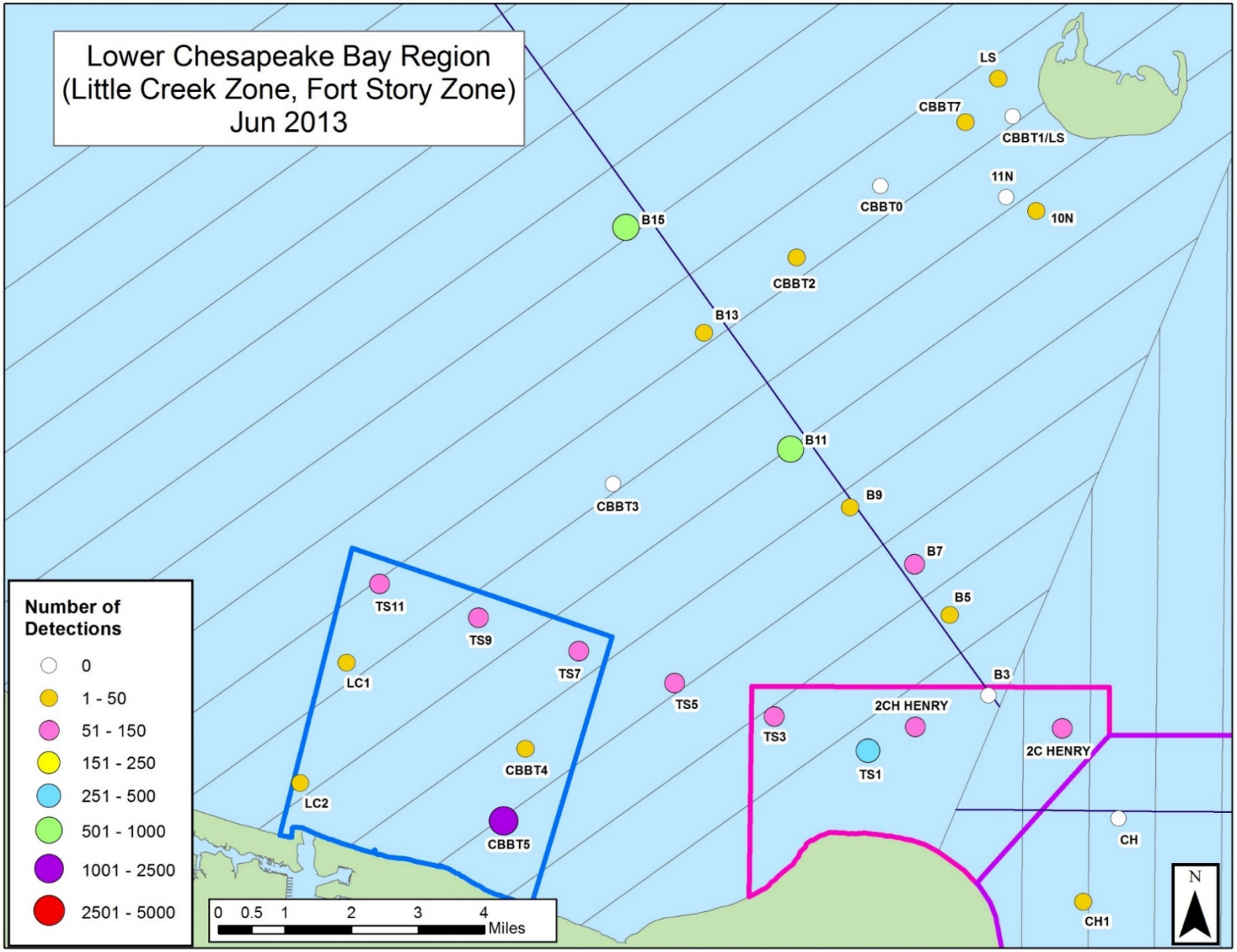

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Jan 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
2C HENRY
TS1
CBBT4
LC2
CBBT5
CH
CH1
N
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles

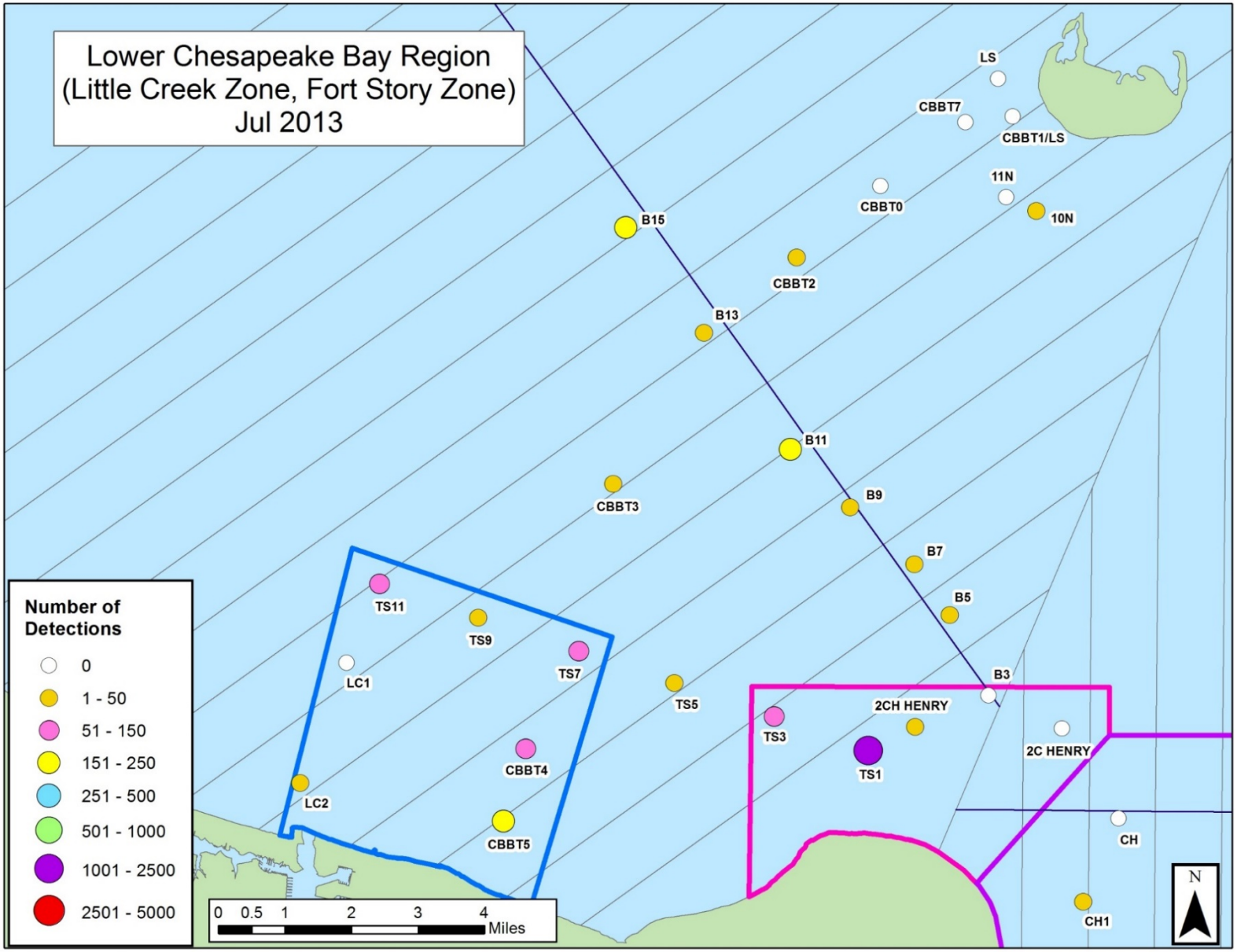

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Feb 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
2C HENRY
TS1
CBBT4
LC2
CBBT5
CH
CH1
N
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles

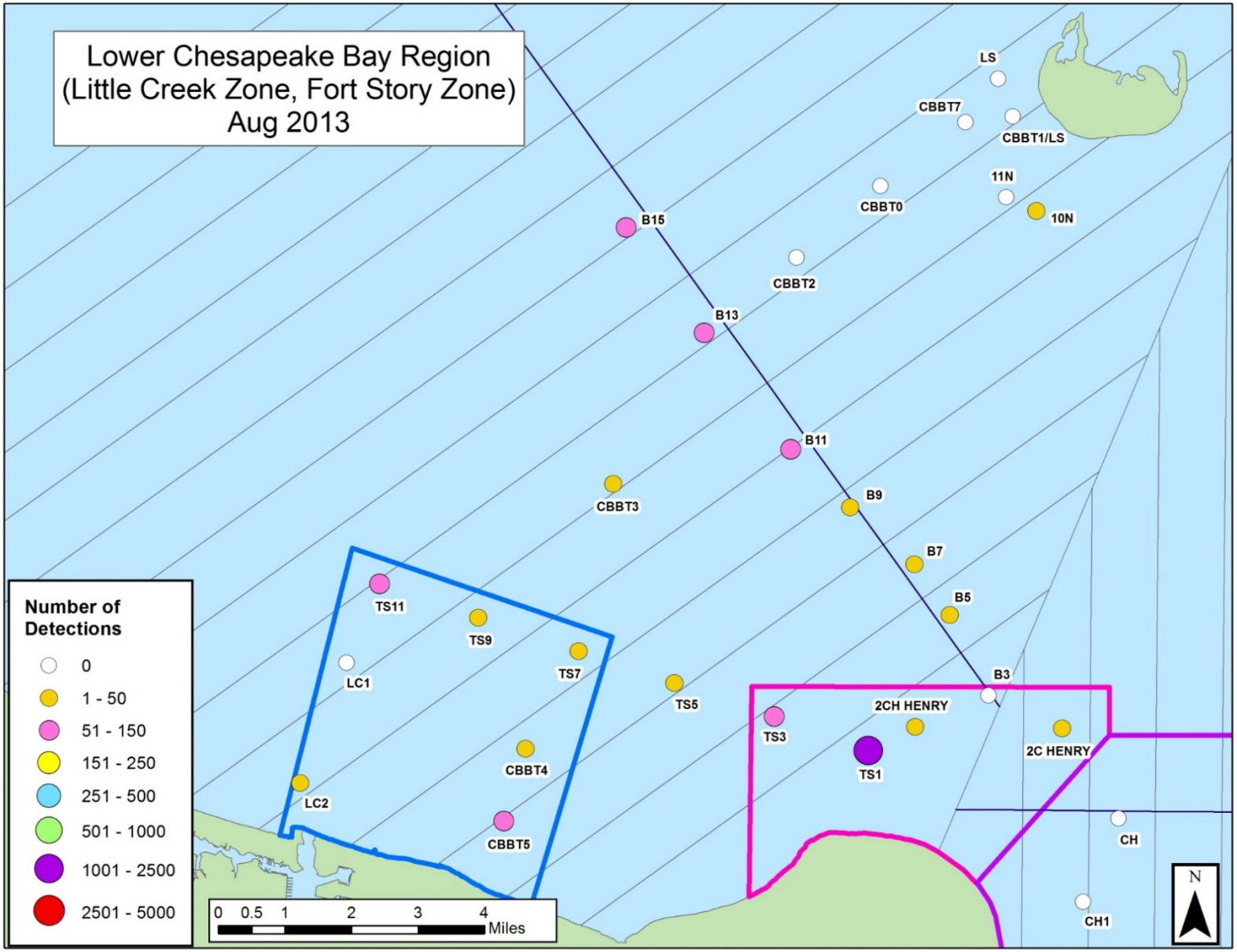

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Mar 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
2C HENRY
TS1
CBBT4
LC2
CBBT5
CH
CH1
N
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles

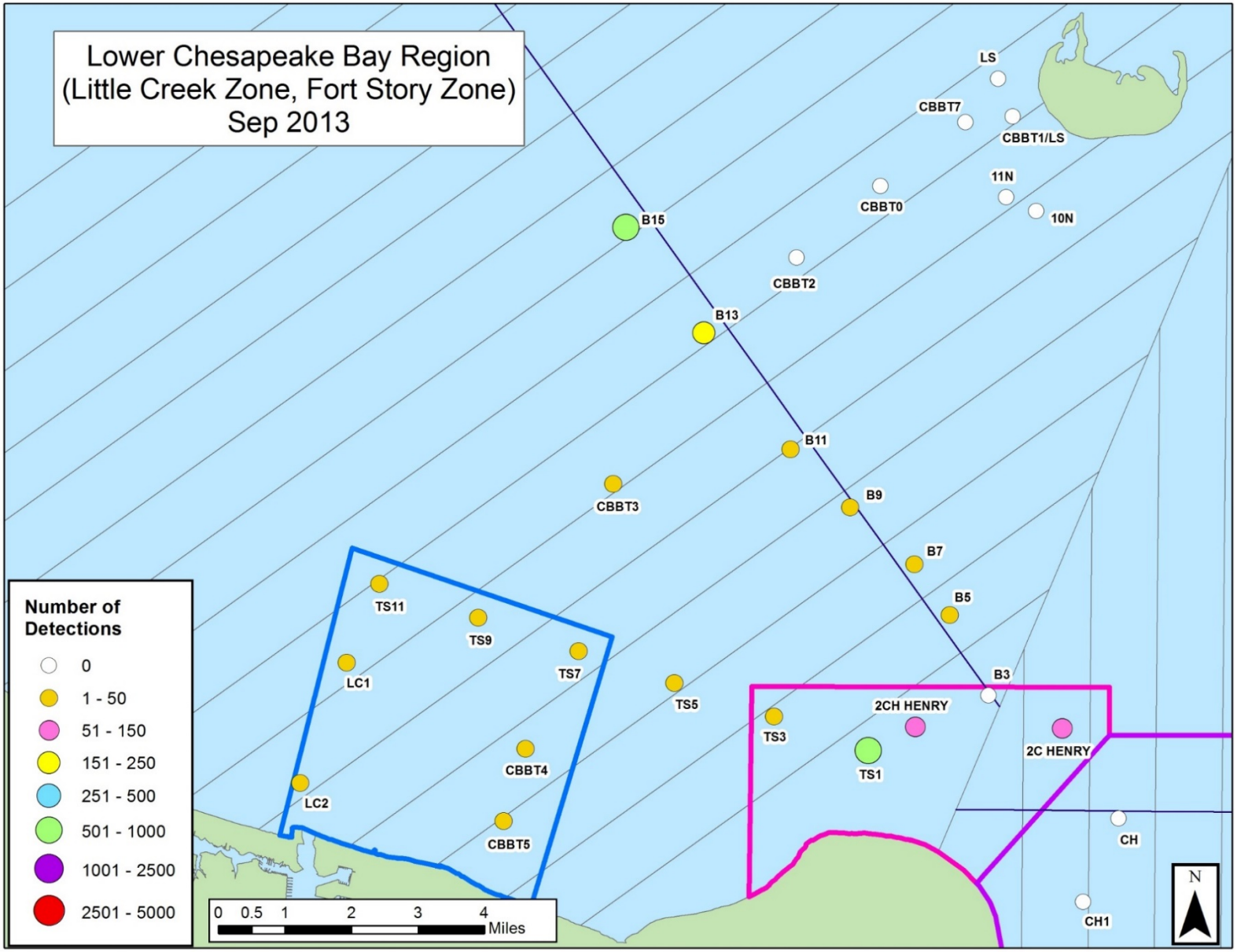

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Apr 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
TS1
2C HENRY
CBBT4
LC2
CBBT5
CH
CH1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles
N

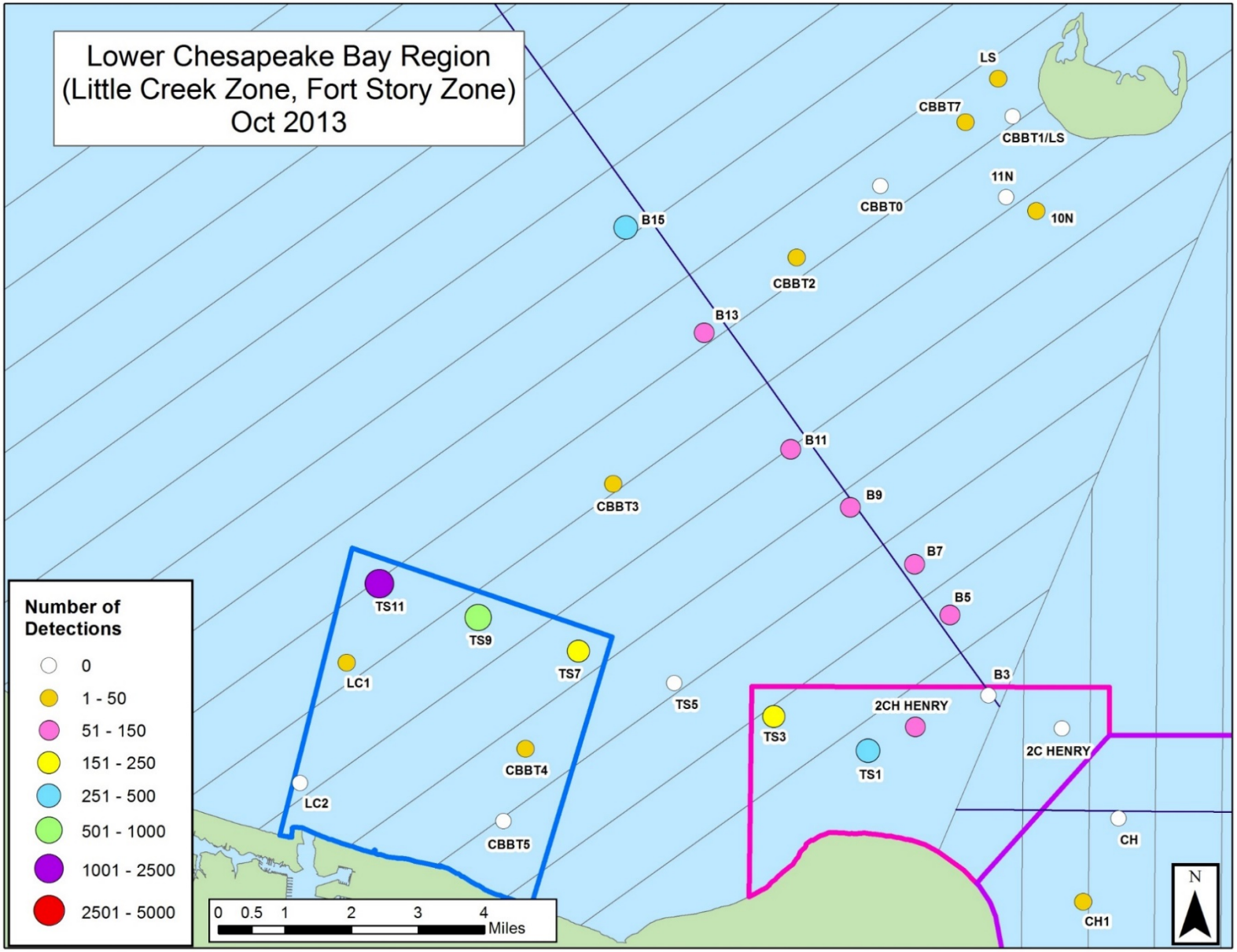

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
May 2013
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles
N
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
TS3
2CH HENRY
2C HENRY
TS1
CBBT4
LC2
CBBT5
CH
CH1

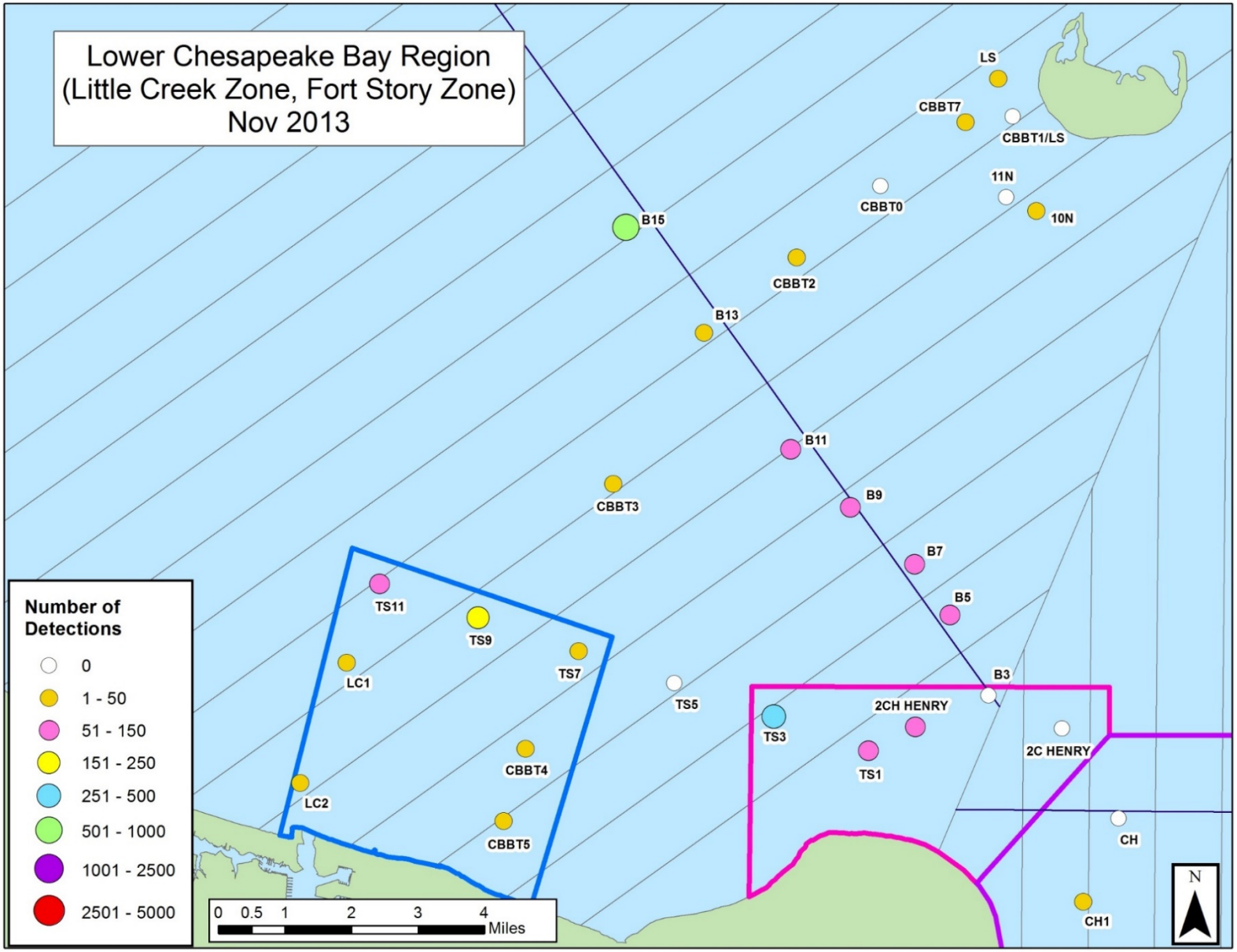

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Jun 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
TS1
2C HENRY
CBBT4
LC2
CBBT5
CH
CH1
N
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles

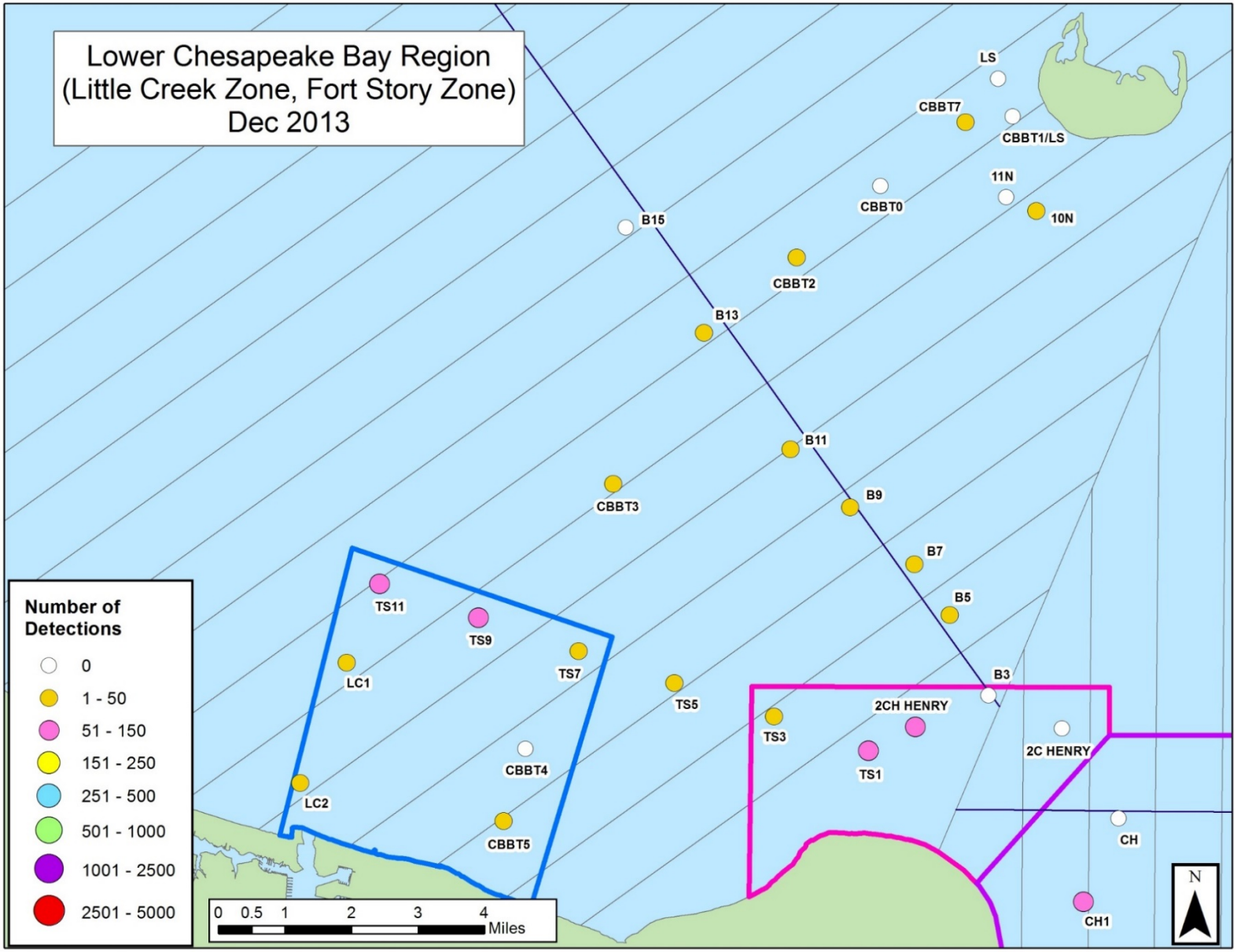

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Jul 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
TS1
2C HENRY
CBBT4
LC2
CBBT5
CH
CH1
N
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles

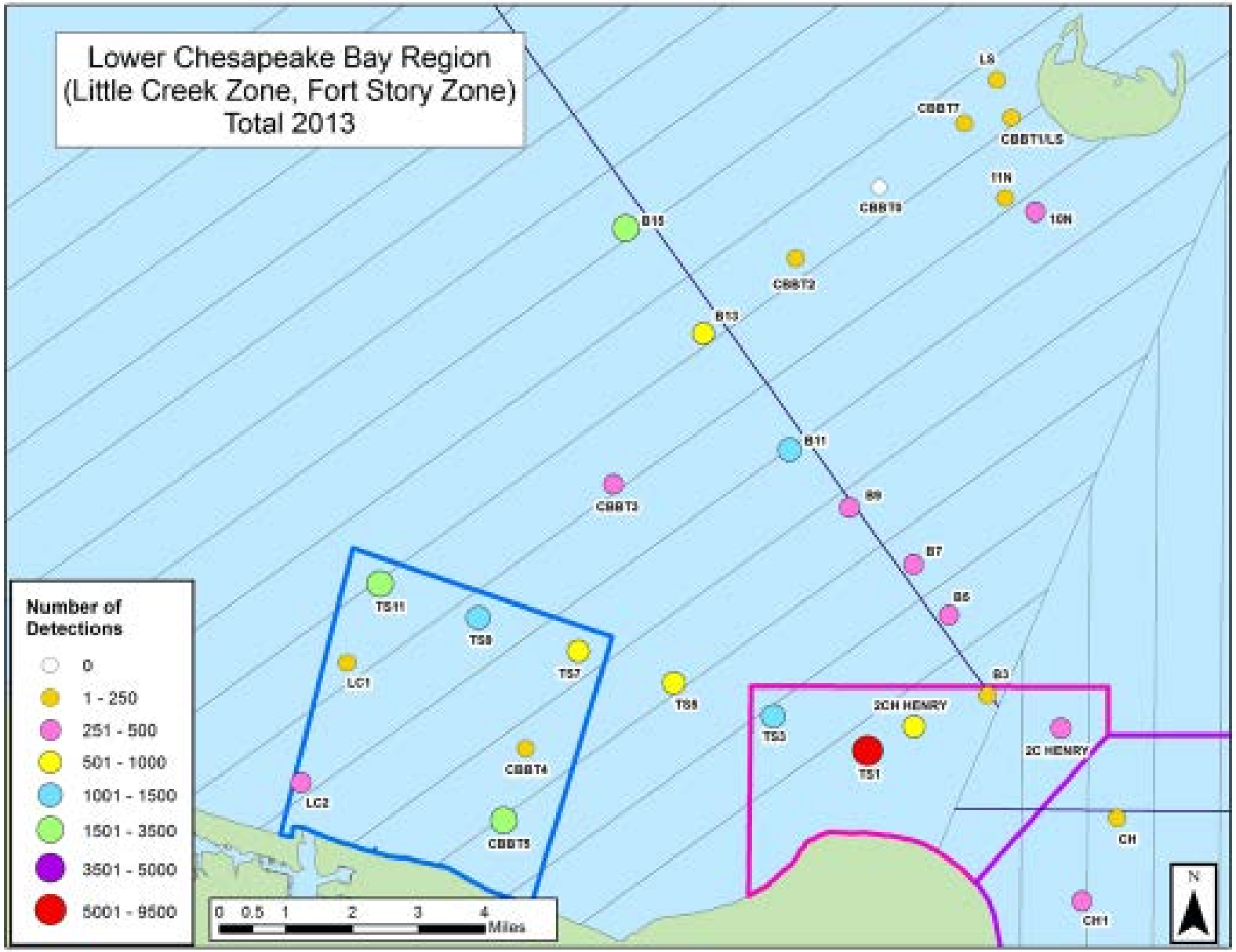

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Aug 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
TS1
2C HENRY
CBBT4
LC2
CBBT5
CH
CH1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles
N

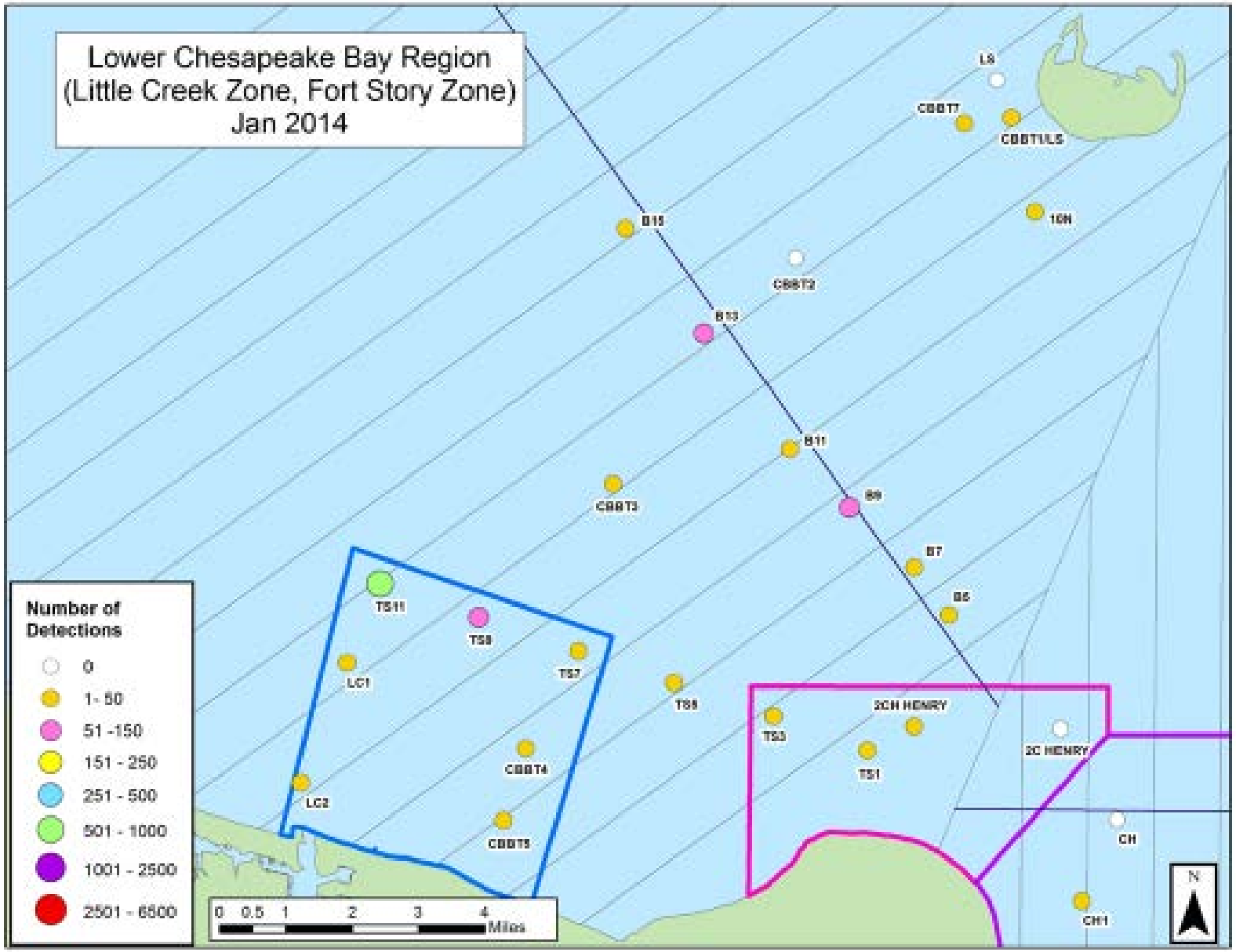

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Sep 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
2C HENRY
TS1
CBBT4
LC2
CBBT5
CH
CH1
N
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles

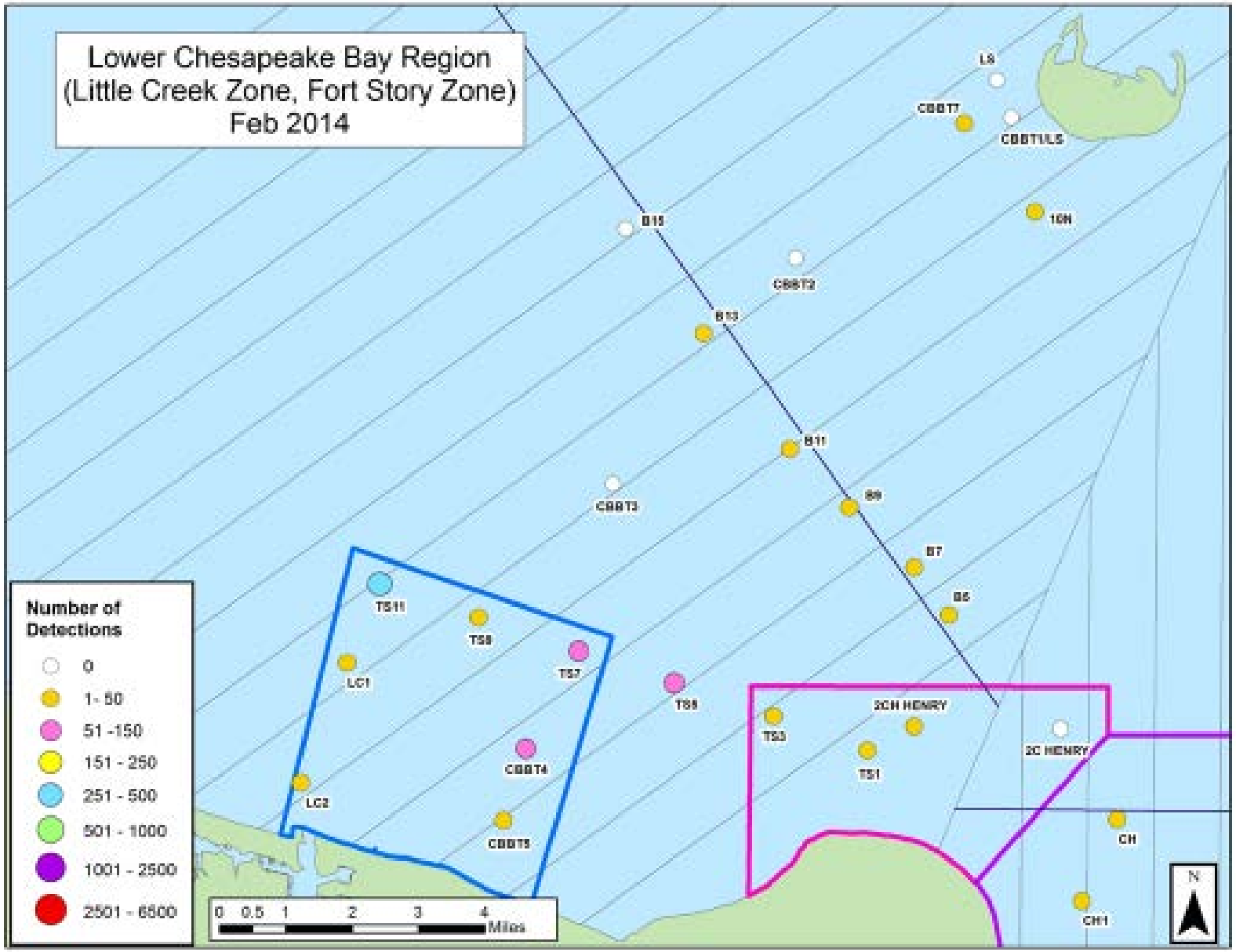

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Oct 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
2C HENRY
TS1
CBBT4
LC2
CBBT5
CH
CH1
N
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles

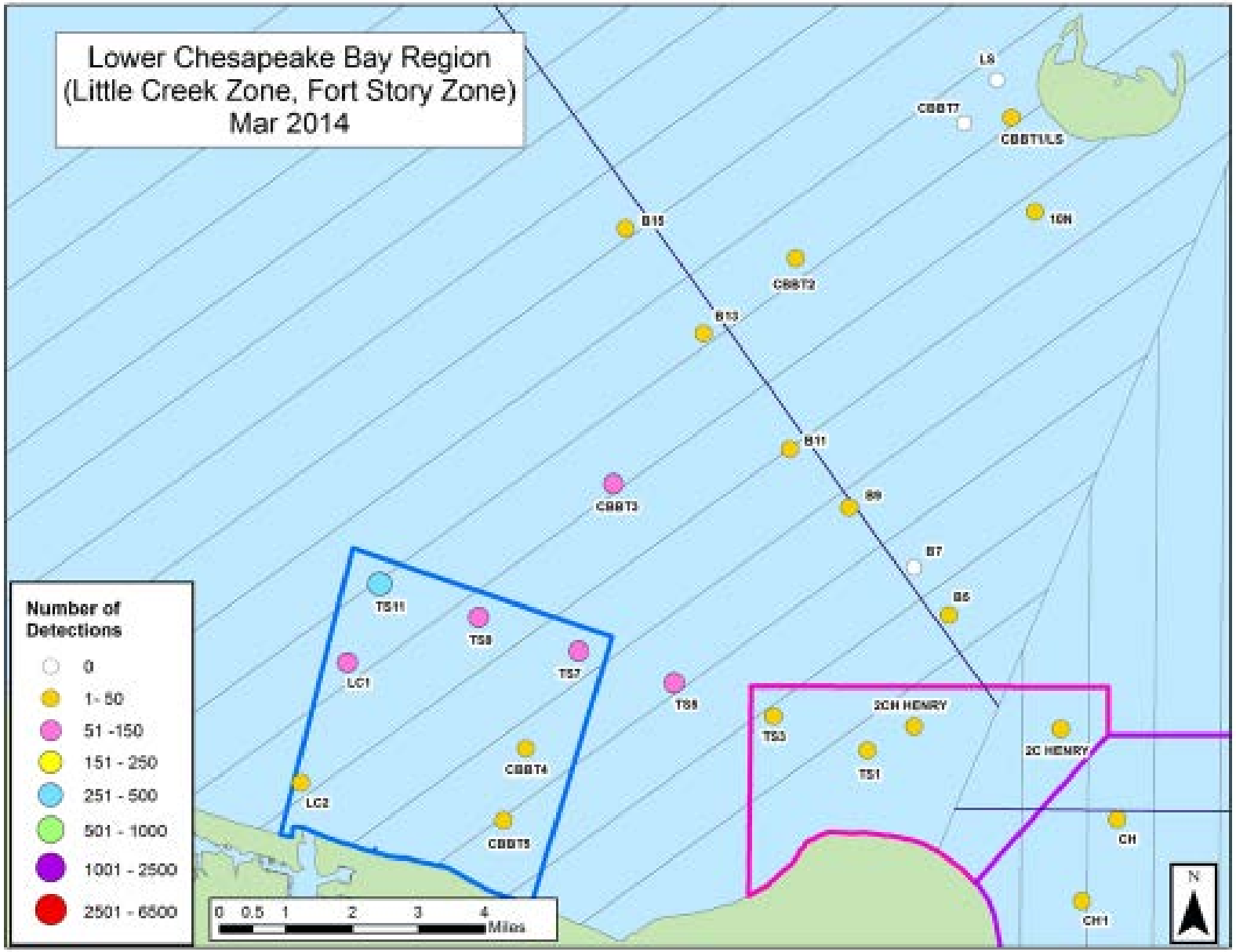

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Nov 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
TS3
2CH HENRY
2C HENRY
TS1
CBBT4
LC2
CBBT5
CH
CH1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles
N

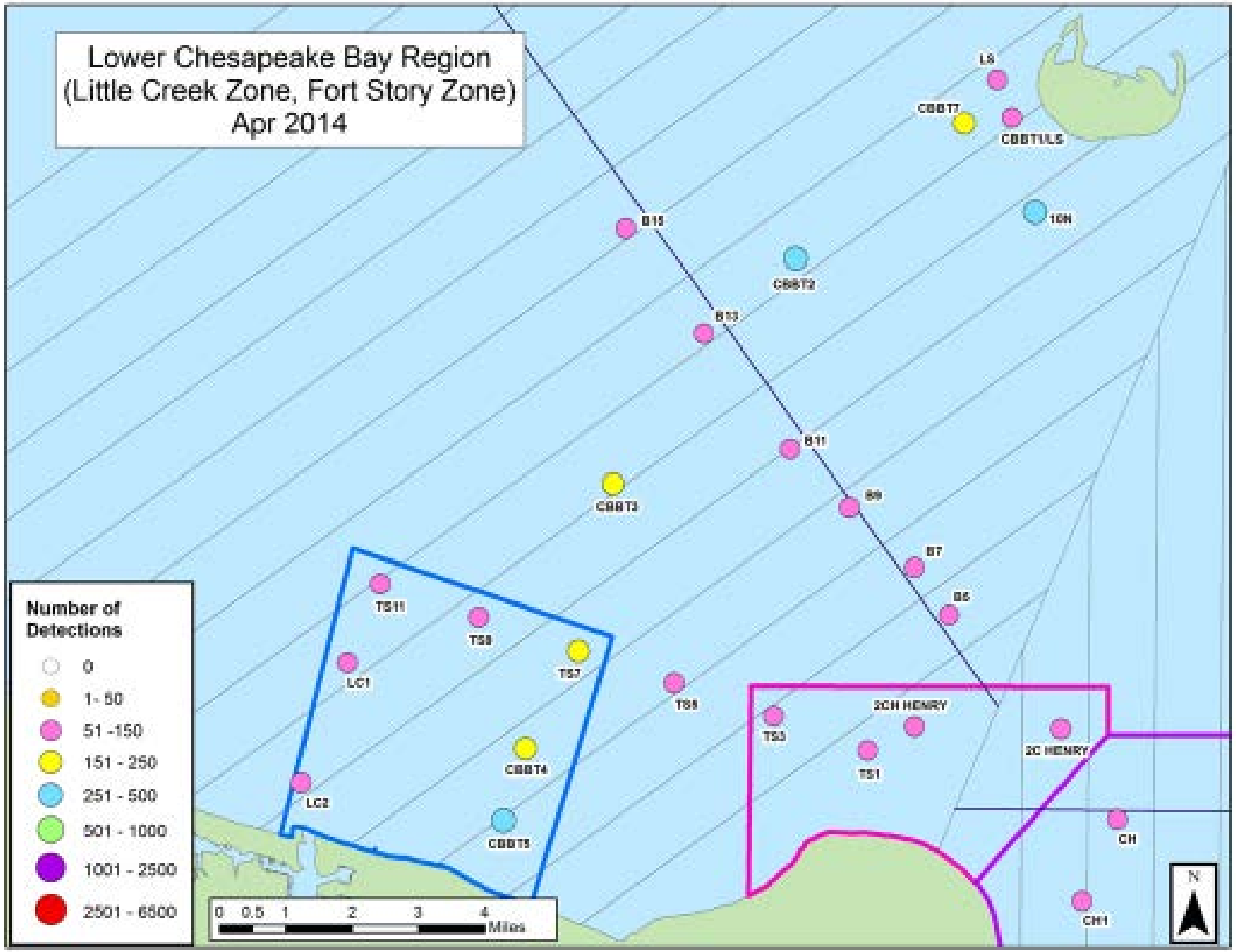

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Dec 2013
LS
CBBT7
CBBT1/LS
11N
CBBT0
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS5
2CH HENRY
TS3
2C HENRY
TS1
CBBT4
LC2
CBBT5
CH
CH1
N
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
0 0.5 1 2 3 4
Miles

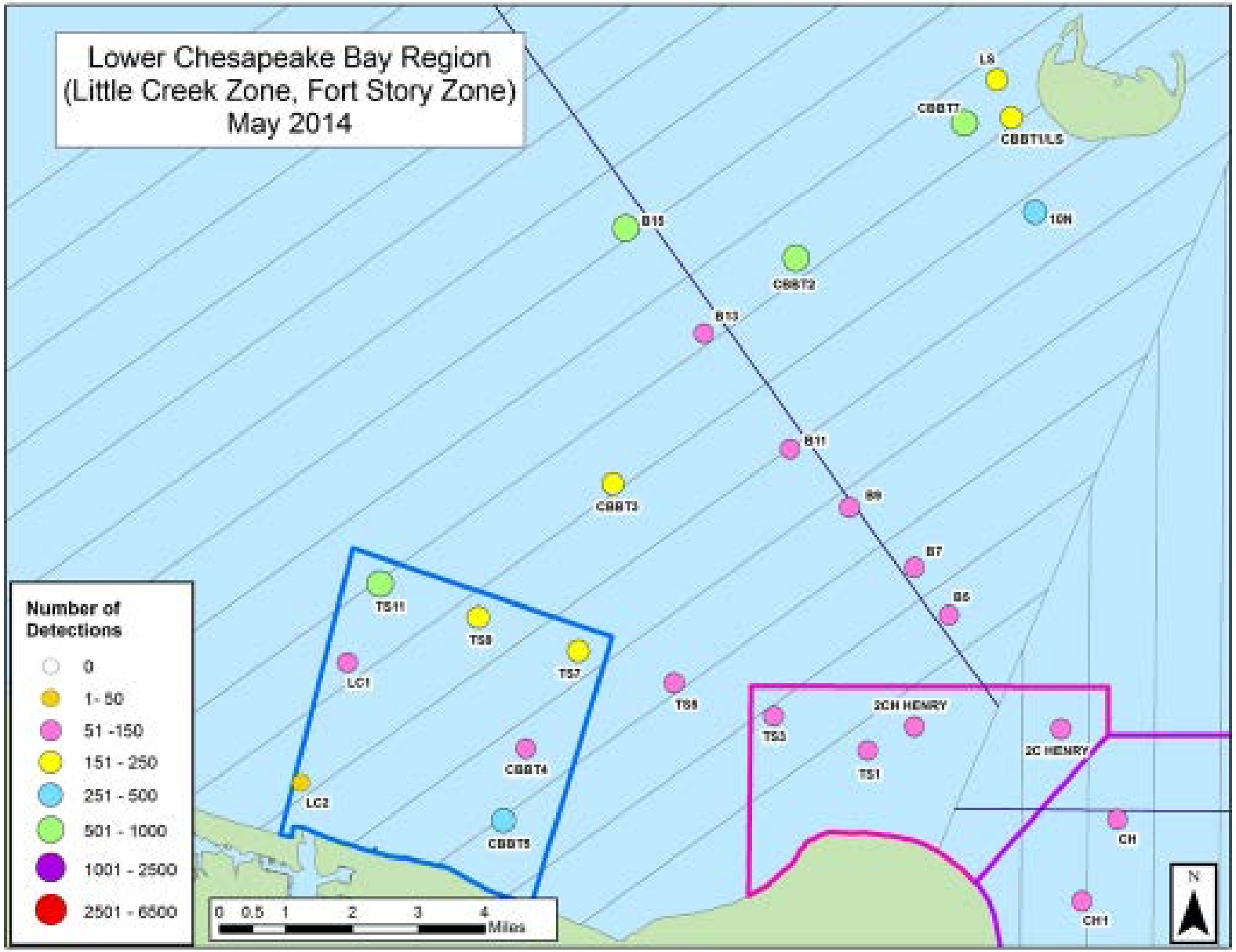

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Total 2013
Number of Detections
0
1 - 250
251 - 500
501 - 1000
1001 - 1500
1501 - 3500
3501 - 5000
5001 - 9500
0 0.5 1 2 3 4
Miles
N
L8
CBBT7
CBBT1/LS
11N
10N
CBBT9
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
B3
TS11
TS9
TS7
LC1
TS8
LC2
CBBT4
CBBT5
TS3
TS1
3CH HENRY
2C HENRY
CH
CH1

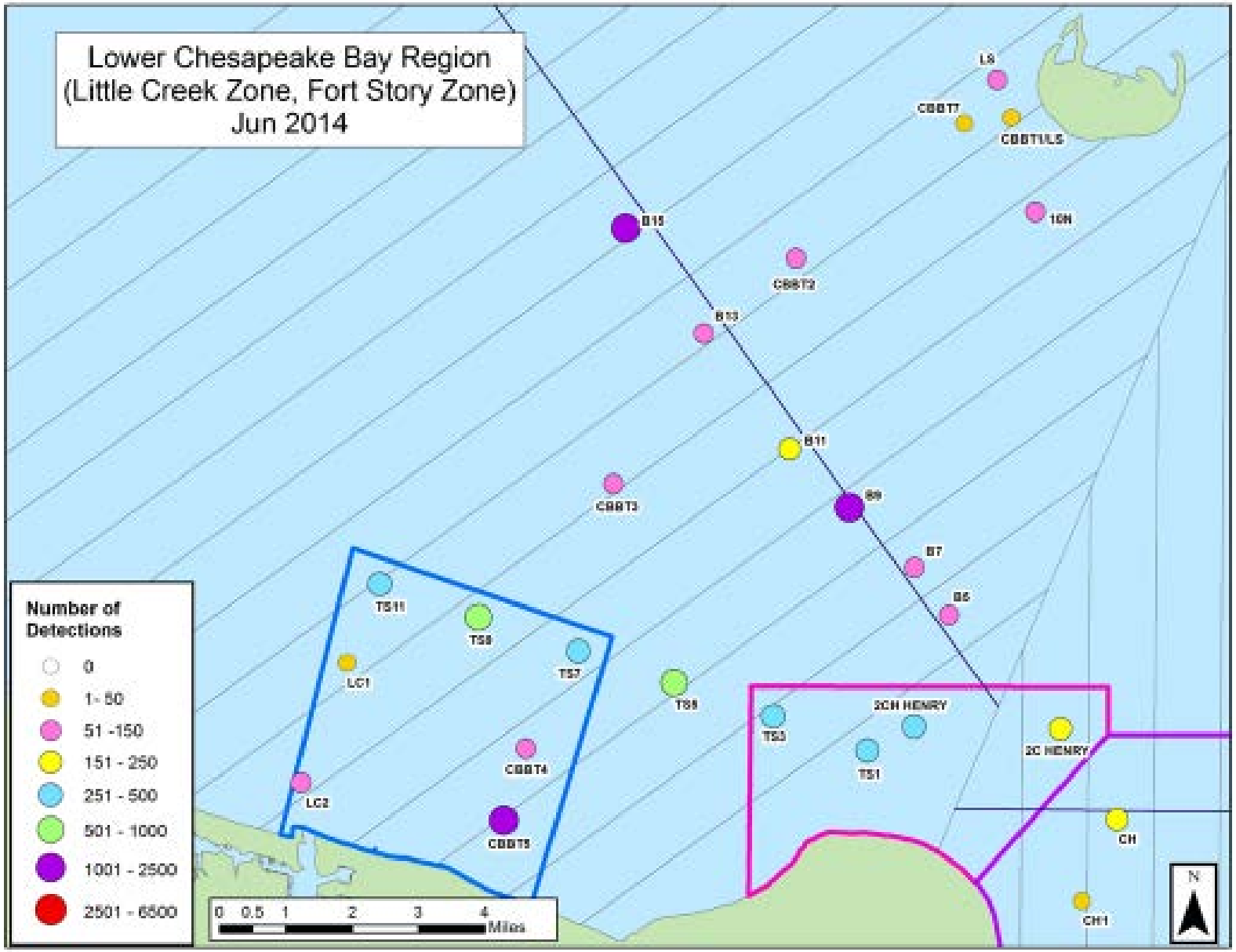

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Jan 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
LS
CBBT7
CBBT1/LS
16N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
LC2
CBBT4
CBBT5
TS8
TS3
TS1
2CH HENRY
2C HENRY
CH
CH1

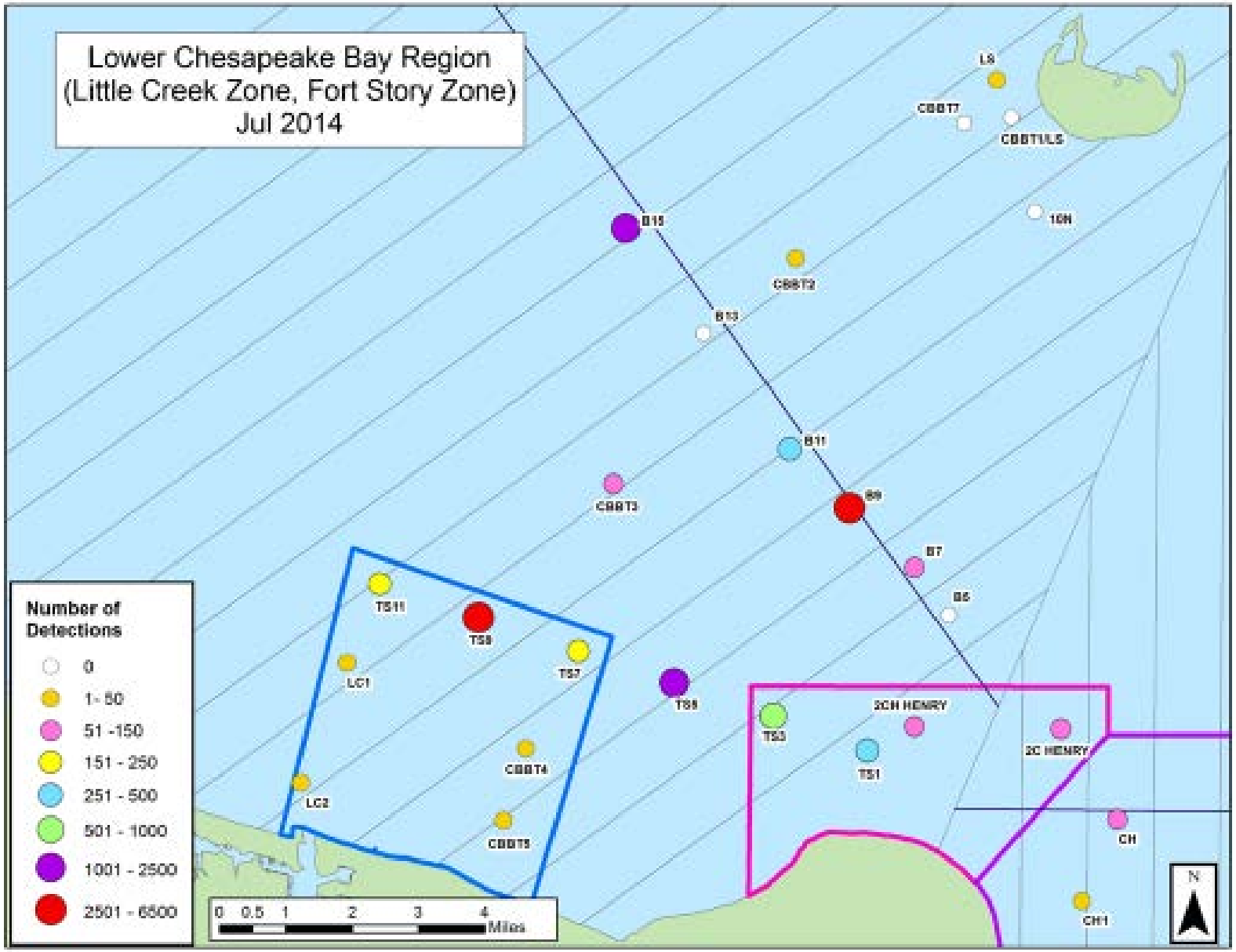

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Feb 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
LS
CBBT7
CBBT1/LS
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
LC2
CBBT4
CBBT5
TS8
TS3
TS1
2CH HENRY
2C HENRY
CH
CH1

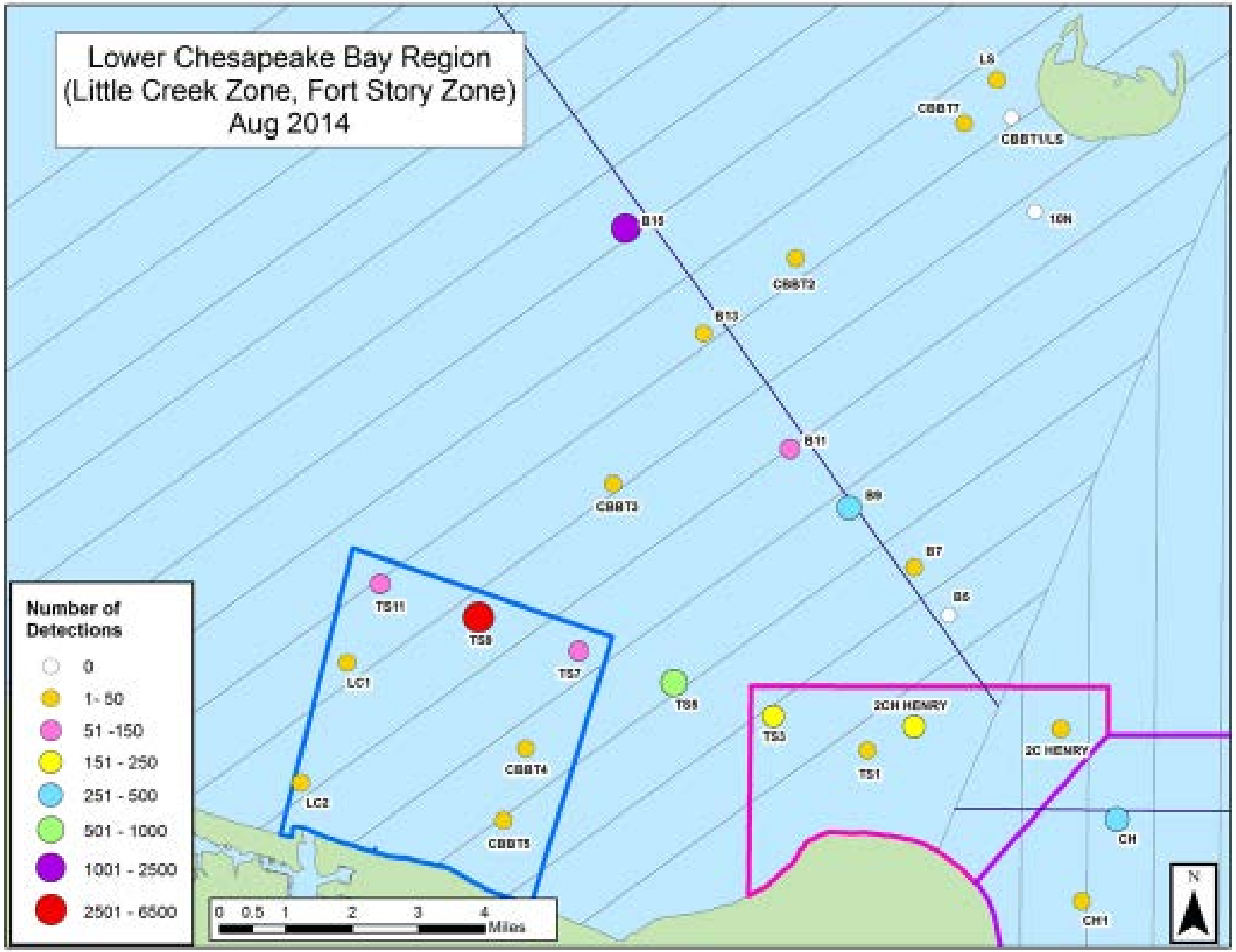

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Mar 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
LS
CBBT7
CBBT1/LS
B15
16N
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
TS8
LC2
CBBT4
CBBT5
TS3
2CH HENRY
TS1
2C HENRY
CH
CH1

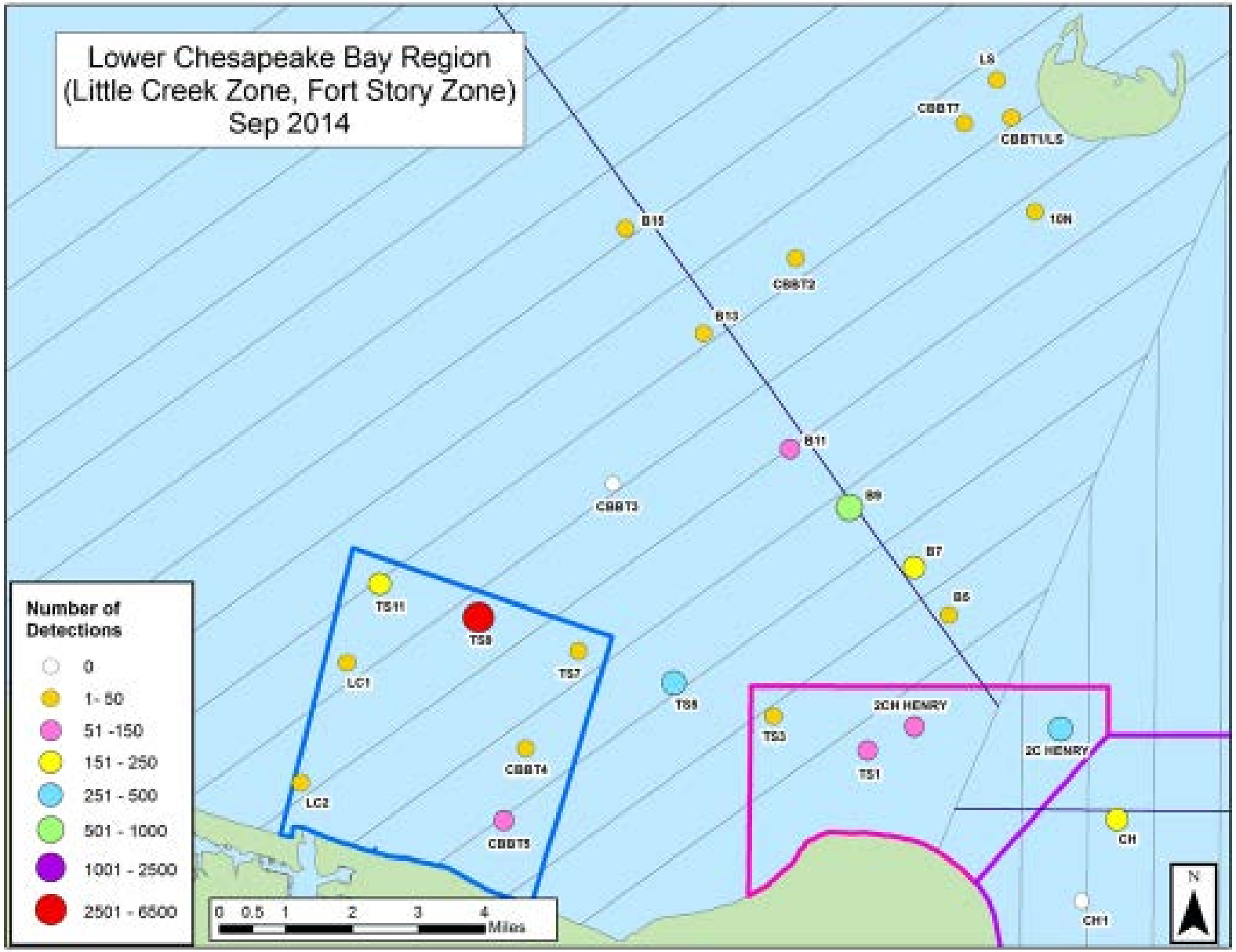

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Apr 2014
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
L6
CBBT7
CBBT1/LS
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
LC2
CBBT4
CBBT5
TS8
TS3
TS1
2CH HENRY
2C HENRY
CH
CH1

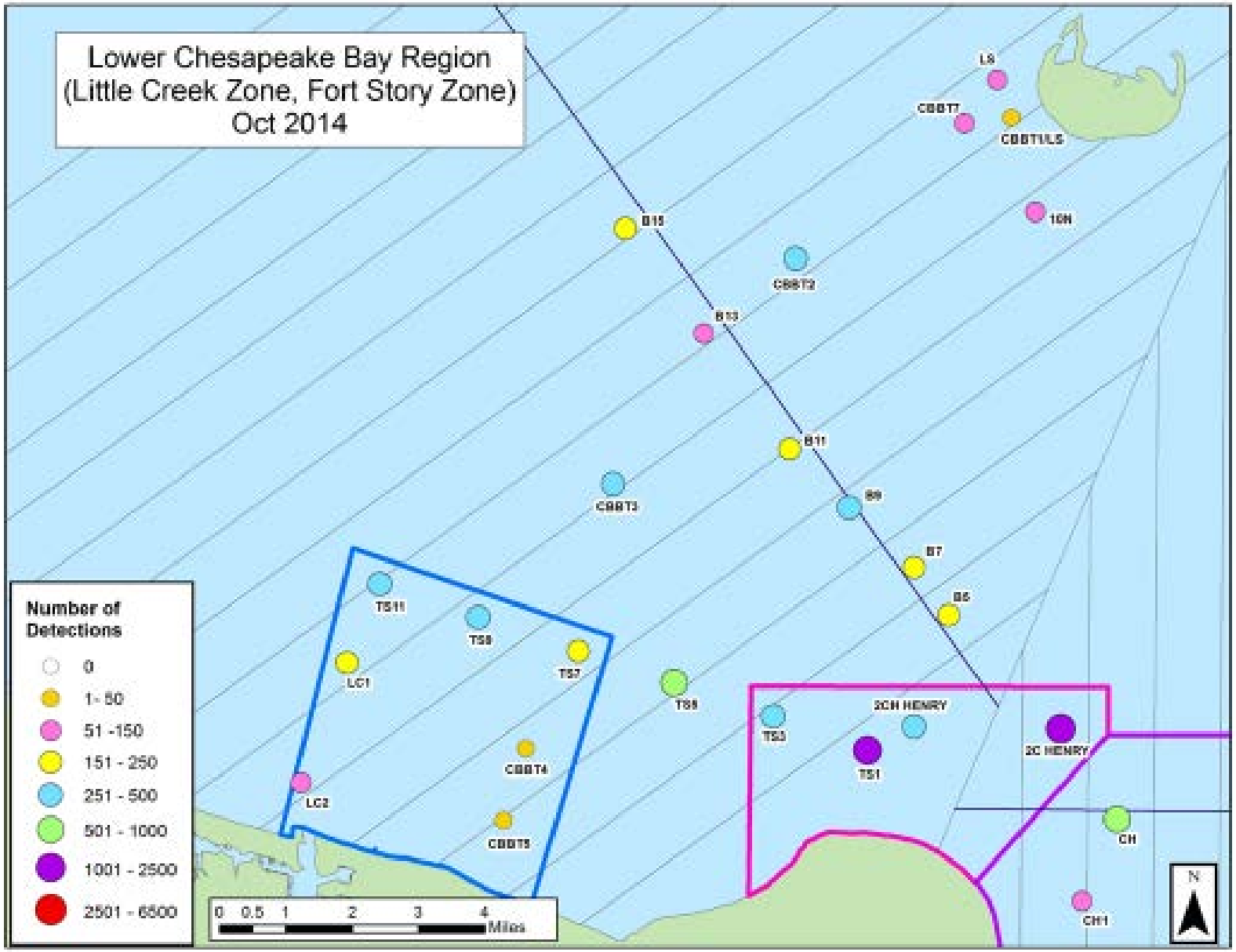

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
May 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
LS
CBBT7
CBBT1/LS
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
LC2
CBBT4
CBBT5
TS8
TS3
TS1
2CH HENRY
2C HENRY
CH
CH1

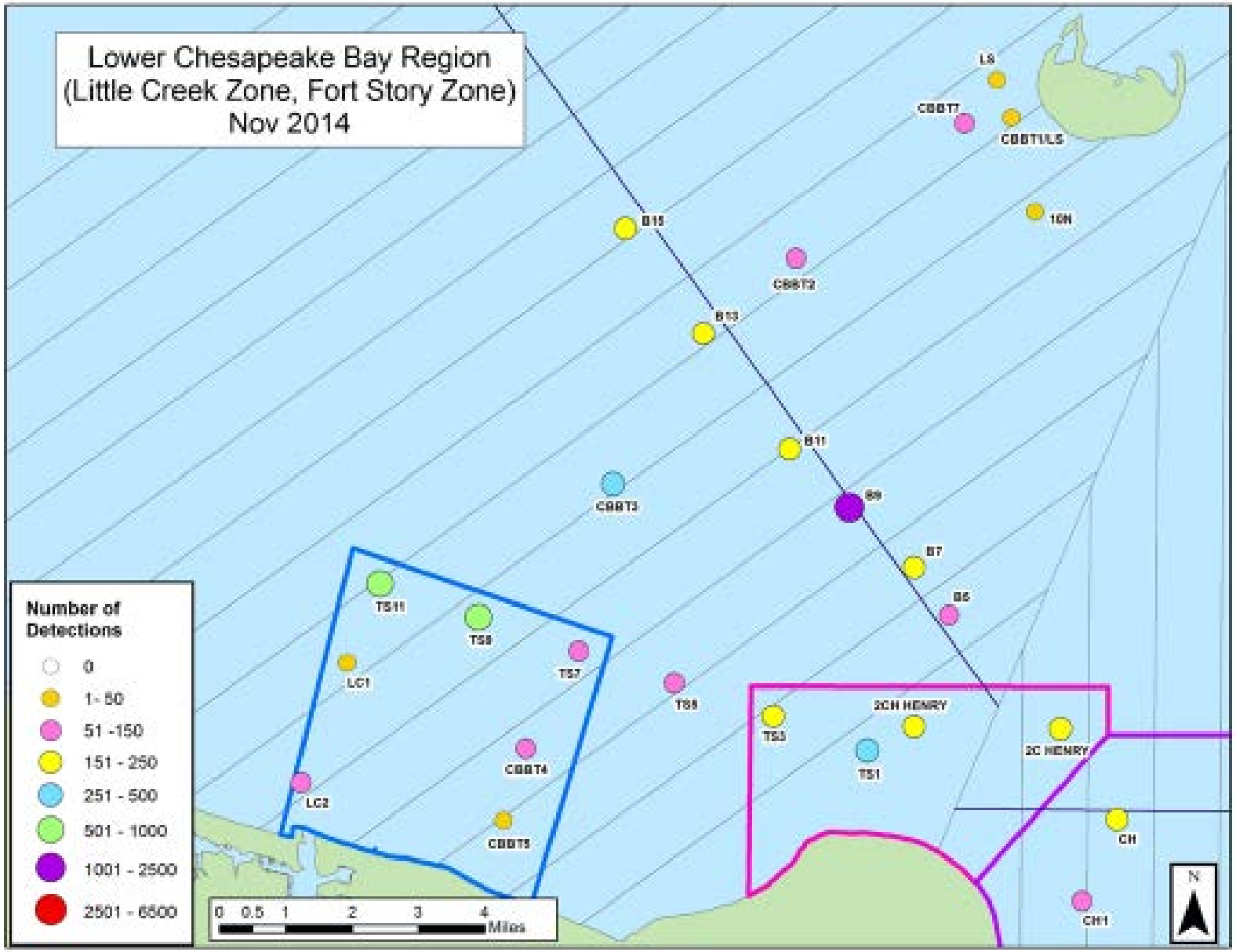

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Jun 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
B15
B13
B11
B9
B7
B5
CBBT2
CBBT3
CBBT4
CBBT5
CBBT7
CBBT1/LS
16N
LS
TS11
TS9
TS7
TS5
TS3
TS1
LC1
LC2
SCH HENRY
2C HENRY
CH
CH1

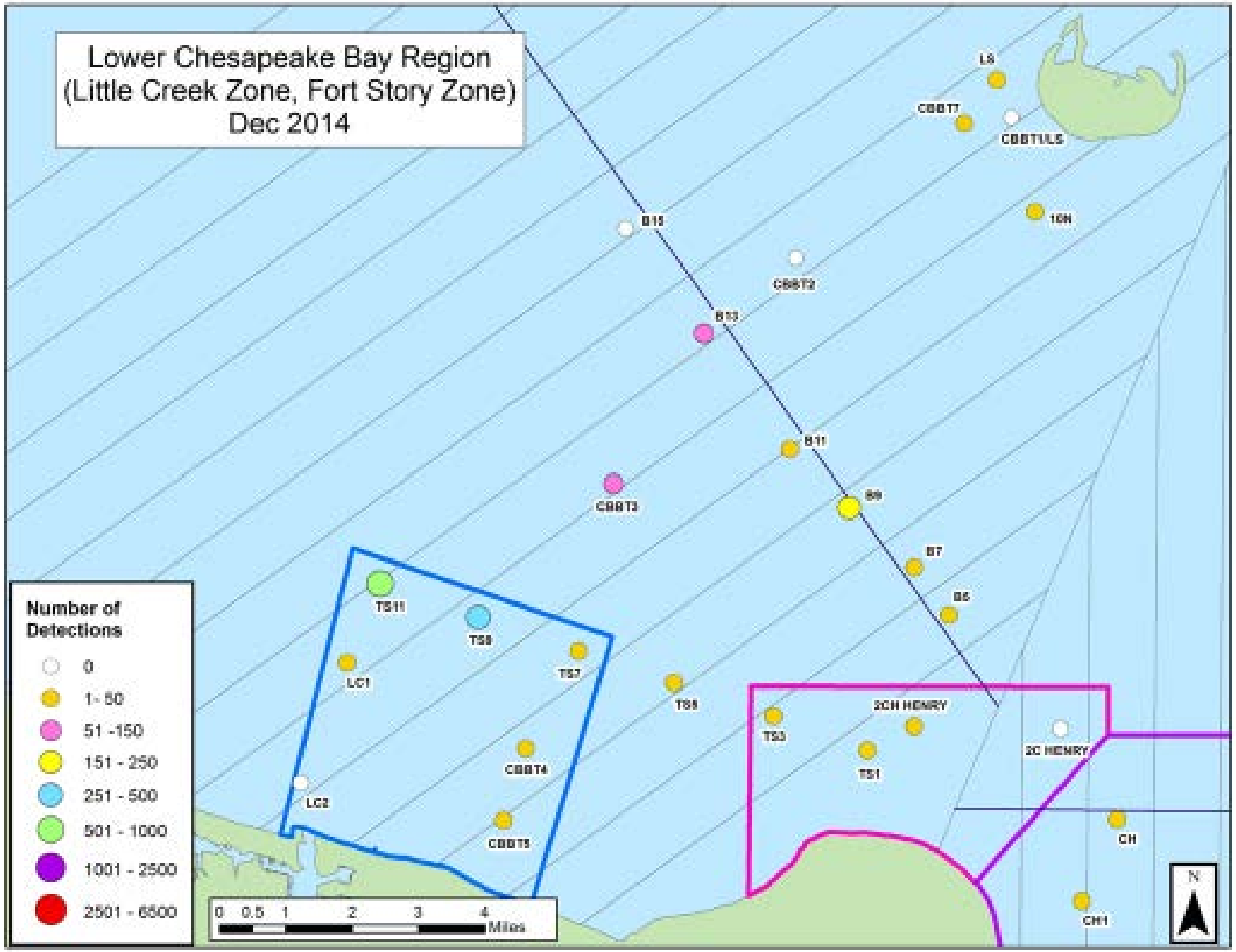

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Jul 2014
Number of Detections
0
1 - 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
L8
CBBT7
CBBT1/LS
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
TS8
LC2
CBBT4
CBBT5
TS3
SCH HENRY
TS1
2C HENRY
CH
CH1

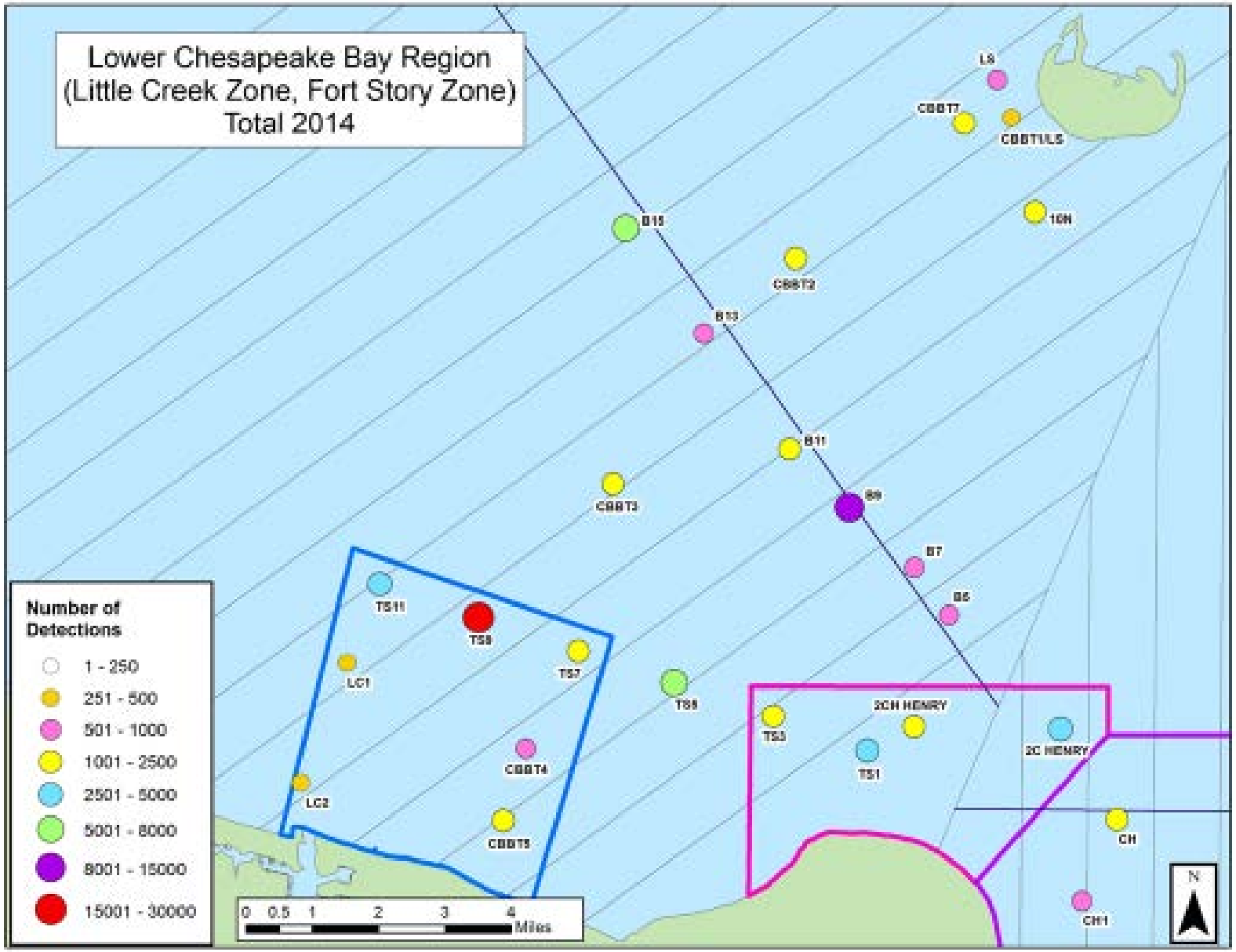

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Aug 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
B15
B13
B11
B9
B7
B5
CBBT2
CBBT3
CBBT4
CBBT5
CBBT7
CBBT1/LS
16N
LS
TS11
TS9
TS7
TS5
TS3
TS1
LC1
LC2
SCH HENRY
2C HENRY
CH
CH1

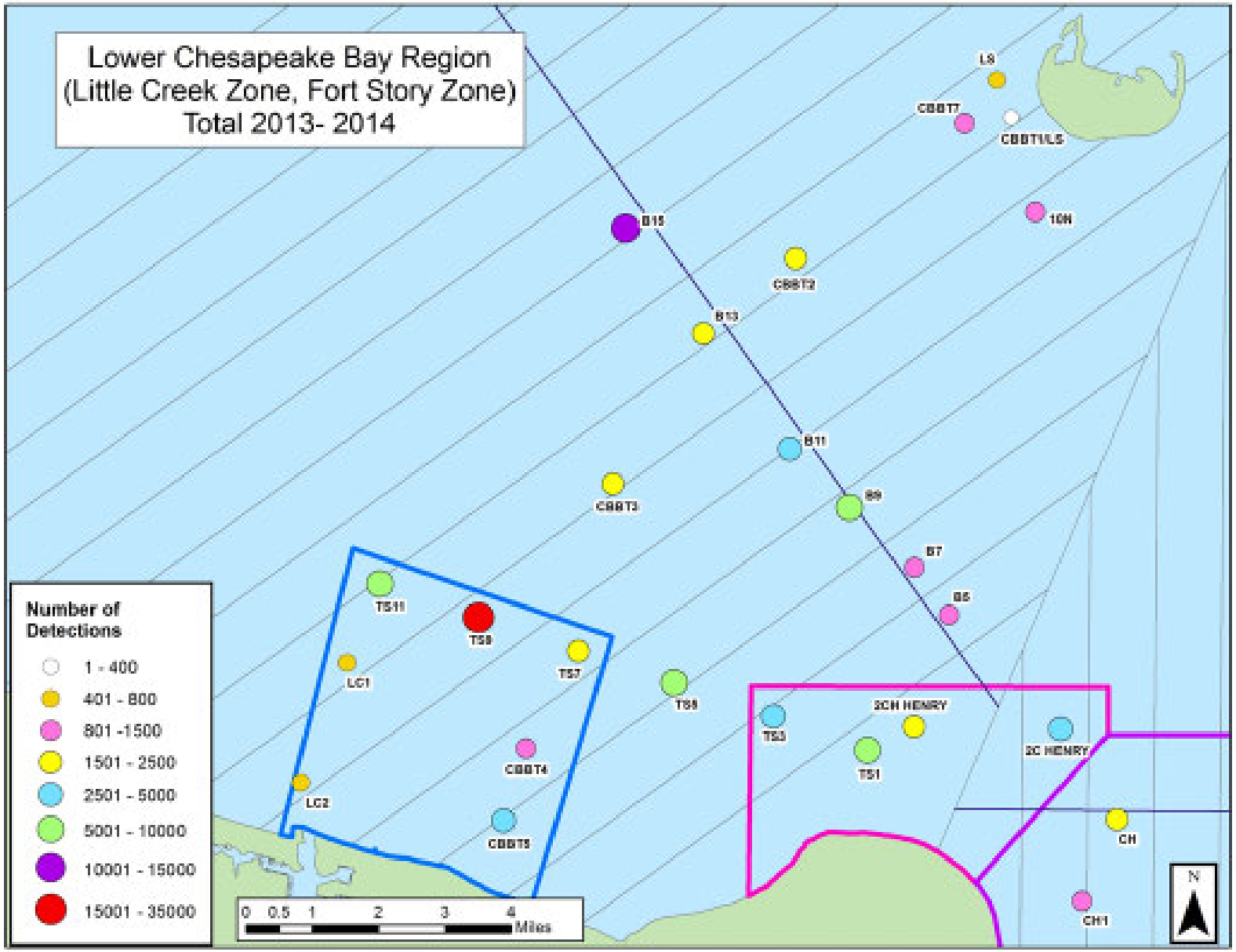

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Sep 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
L8
CBBT7
CBBT1/LS
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
LC2
CBBT4
CBBT5
TS8
TS3
TS1
2CH HENRY
2C HENRY
CH
CH1


Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Oct 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
B15
B13
B11
B9
B7
B5
CBBT1
CBBT1LS
CBBT2
CBBT3
CBBT4
CBBT5
TS11
TS9
TS7
TS5
TS3
TS1
LC1
LC2
SCH HENRY
2C HENRY
CH
CH1
1GN
L5

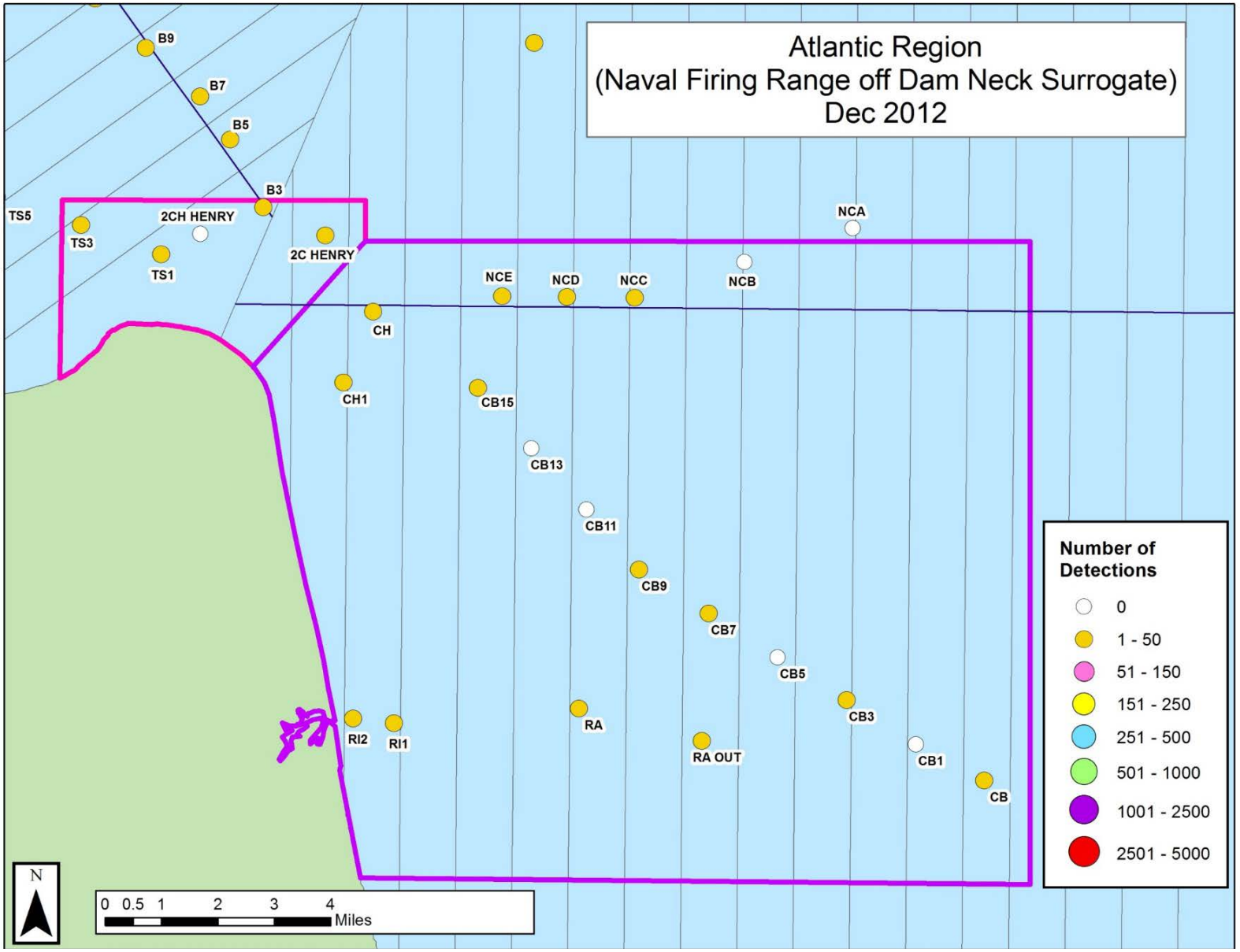

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Nov 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
L8
CBBT7
CBBT1/LS
10N
B12
CBBT2
B10
B11
CBBT3
B9
B7
B6
TS11
TS9
TS7
LC1
LC2
CBBT4
CBBT5
TS8
TS3
TS1
2CH HENRY
2C HENRY
CH
CH1

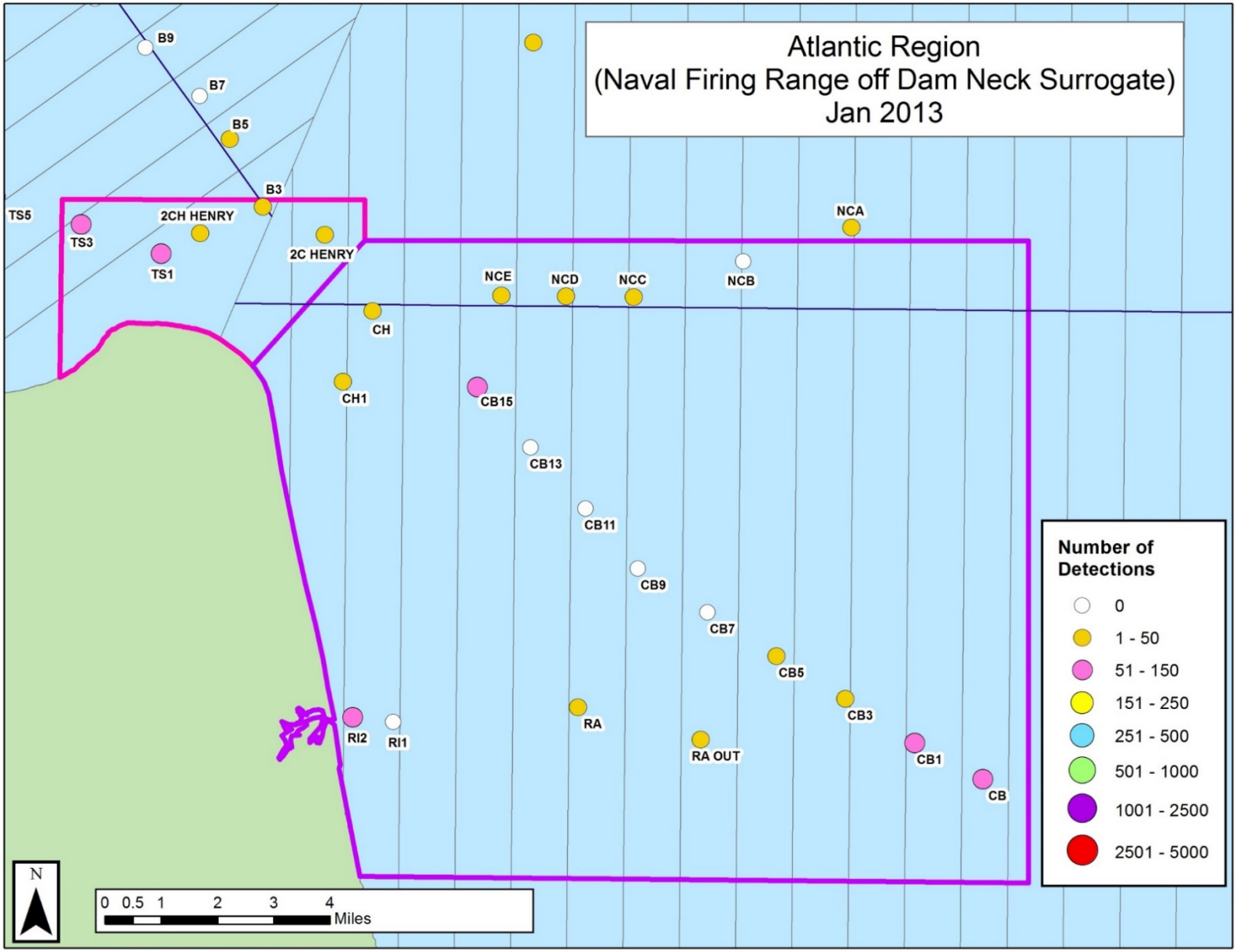

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Dec 2014
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
0 0.5 1 2 3 4
Miles
N
L8
CBBT7
CBBT1/LS
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
LC2
CBBT4
CBBT5
TS6
TS3
TS1
2CH HENRY
2C HENRY
CH
CH1

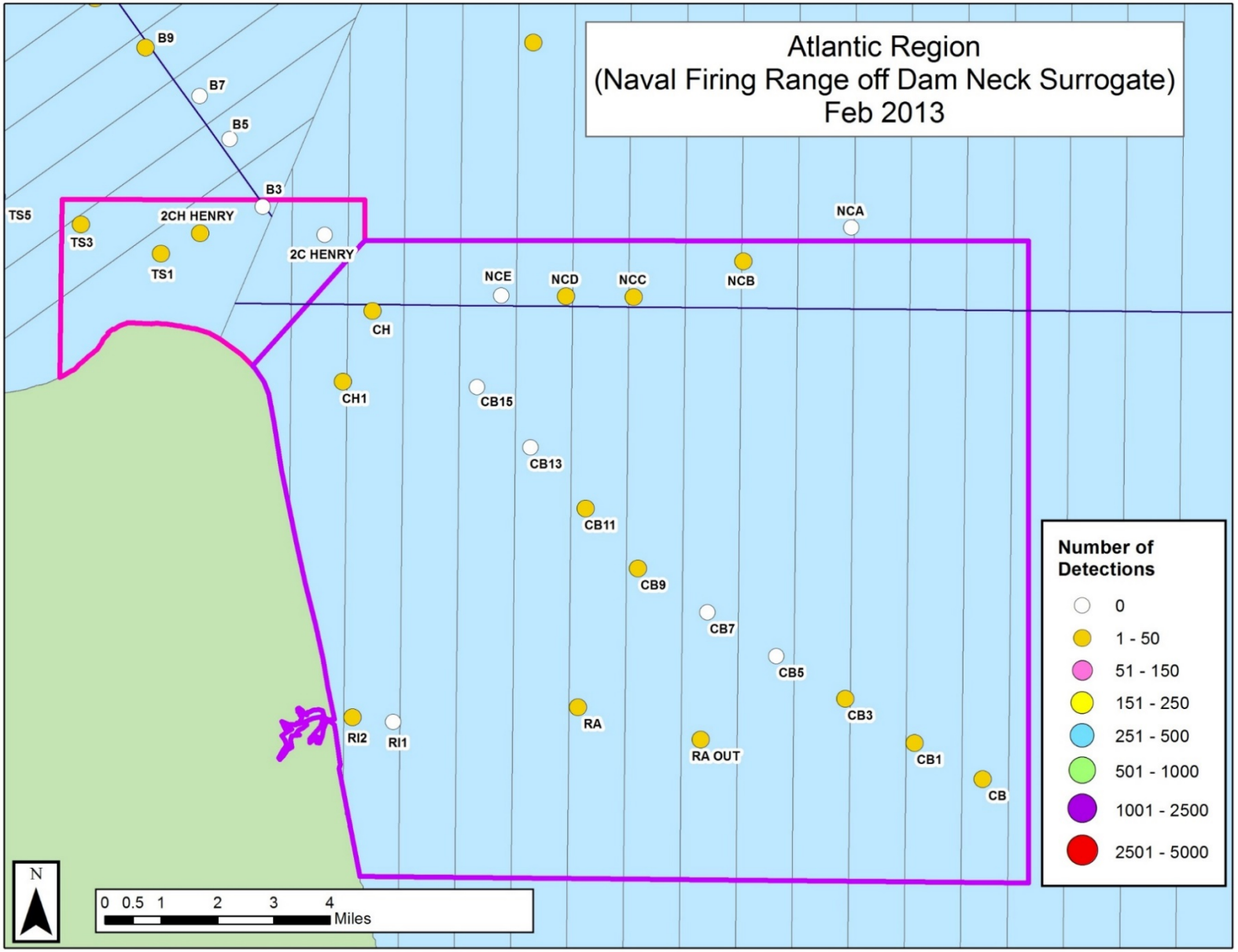

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Total 2014
Number of Detections
1 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
5001 - 8000
8001 - 15000
15001 - 30000
0 0.5 1 2 3 4
Miles
N
LS
CBBT7
CBBT1/LS
B15
16N
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
LC2
CBBT4
CBBT5
TS8
TS3
TS1
SCH HENRY
2C HENRY
CH
CH1

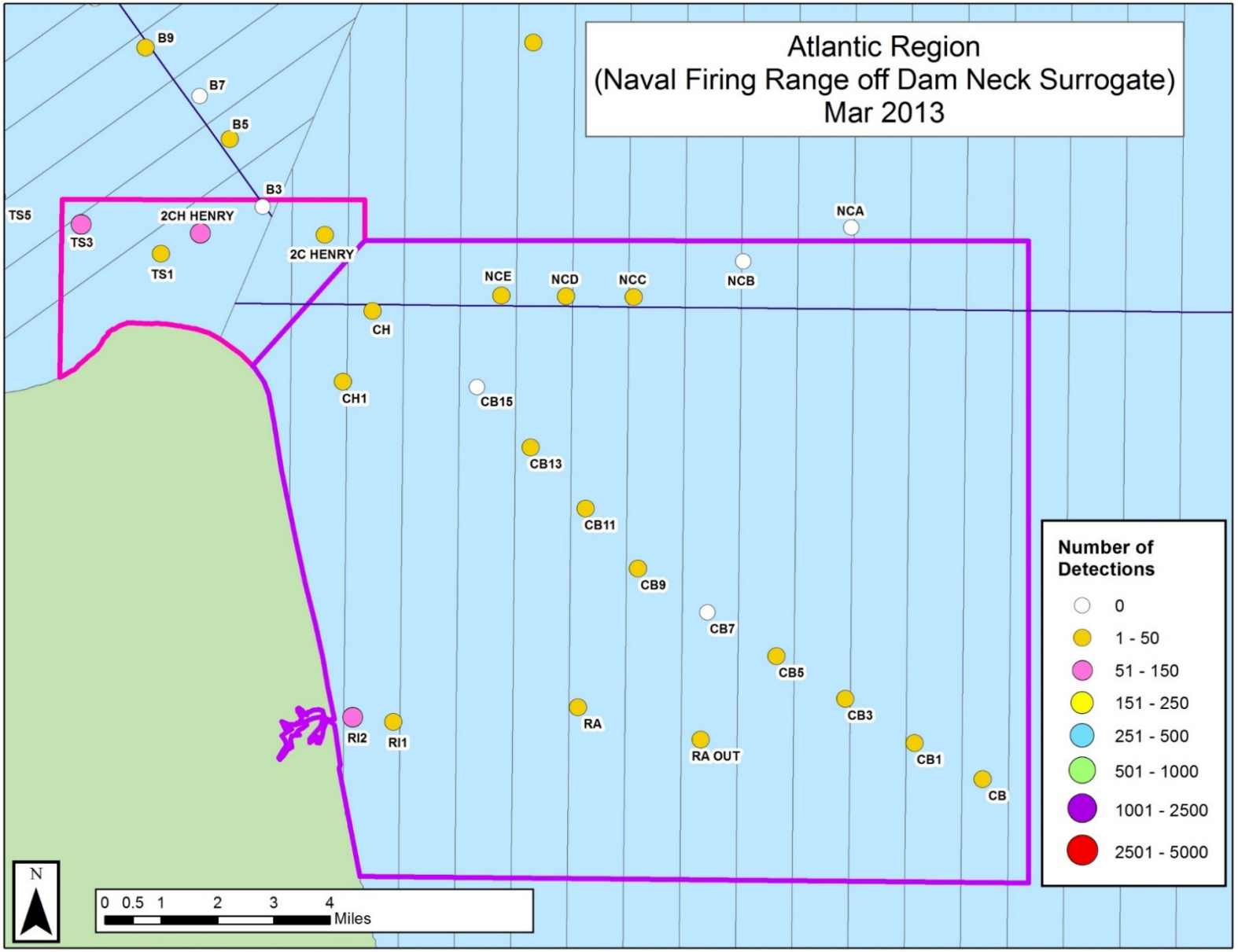

Lower Chesapeake Bay Region
(Little Creek Zone, Fort Story Zone)
Total 2013- 2014
Number of Detections
1 - 400
401 - 800
801 -1500
1501 - 2500
2501 - 5000
5001 - 10000
10001 - 15000
15001 - 35000
0 0.5 1 2 3 4
Miles
N
L8
CBBT7
CBBT1/LS
10N
B15
CBBT2
B13
B11
CBBT3
B9
B7
B5
TS11
TS9
TS7
LC1
TS8
LC2
CBBT4
CBBT5
TS3
2CH HENRY
TS1
2C HENRY
CH
CH1

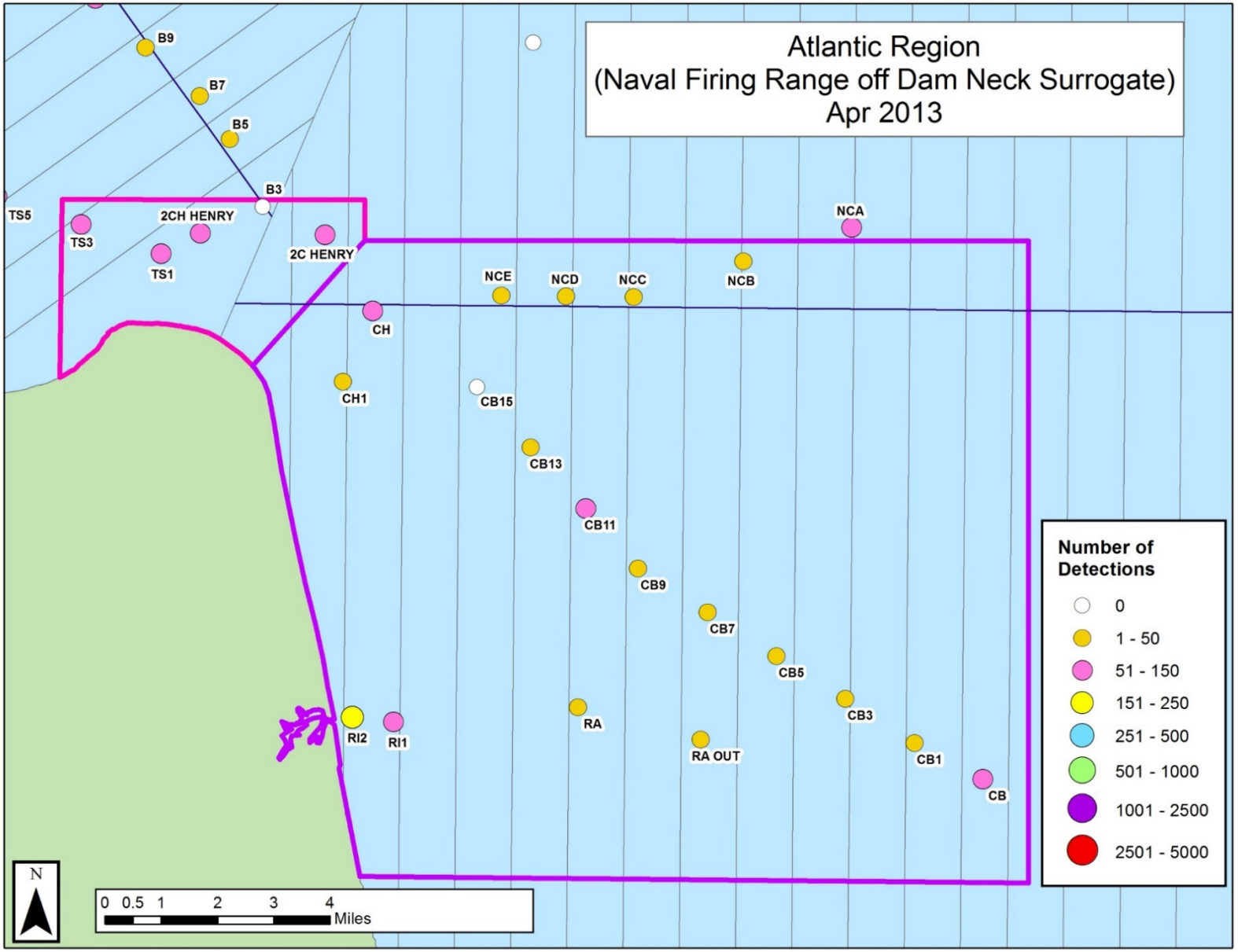
9.8 APPENDIX 4.4.6: ATLANTIC REGION (NAVAL FIRING RANGE OFF DAM NECK SURROGATE)

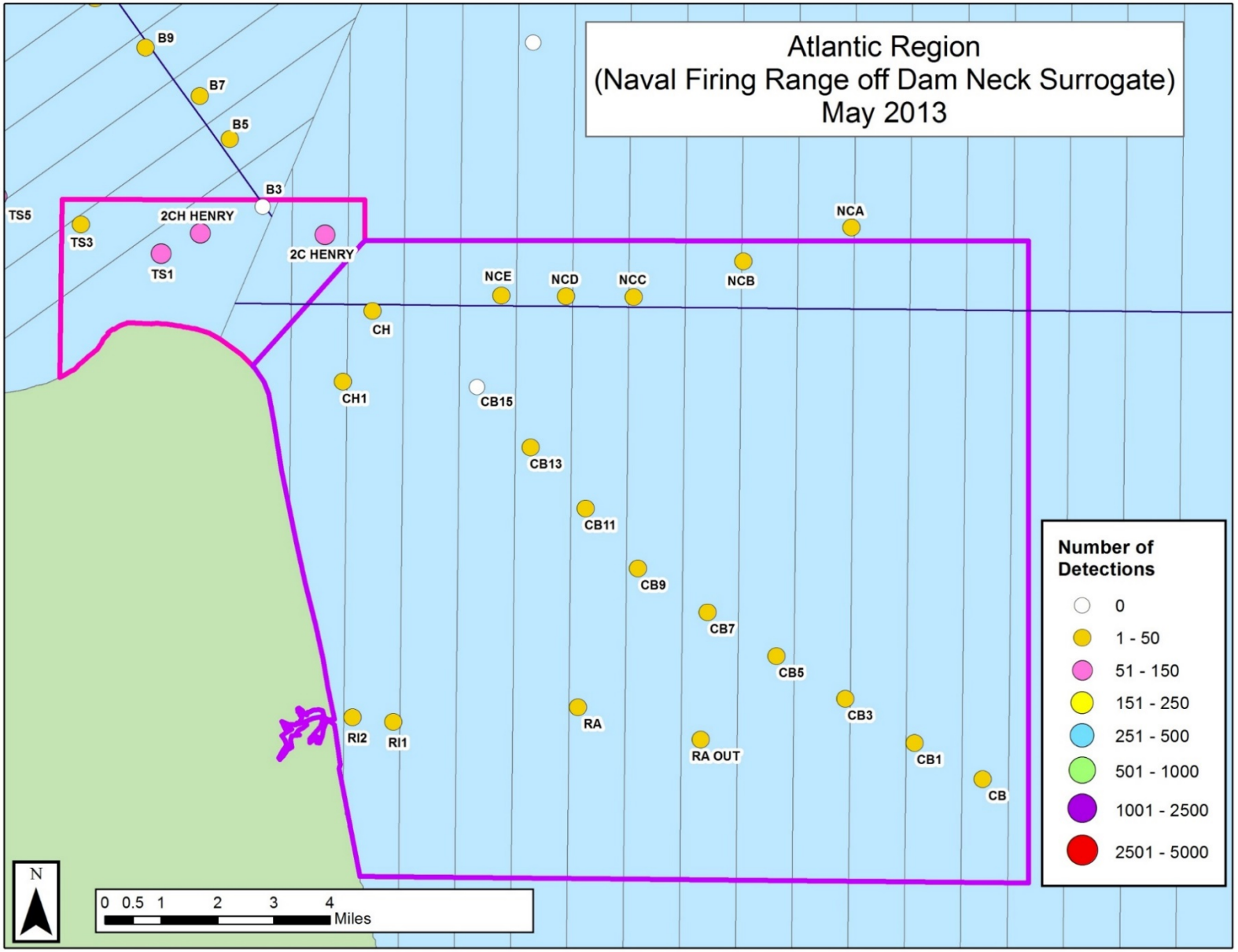


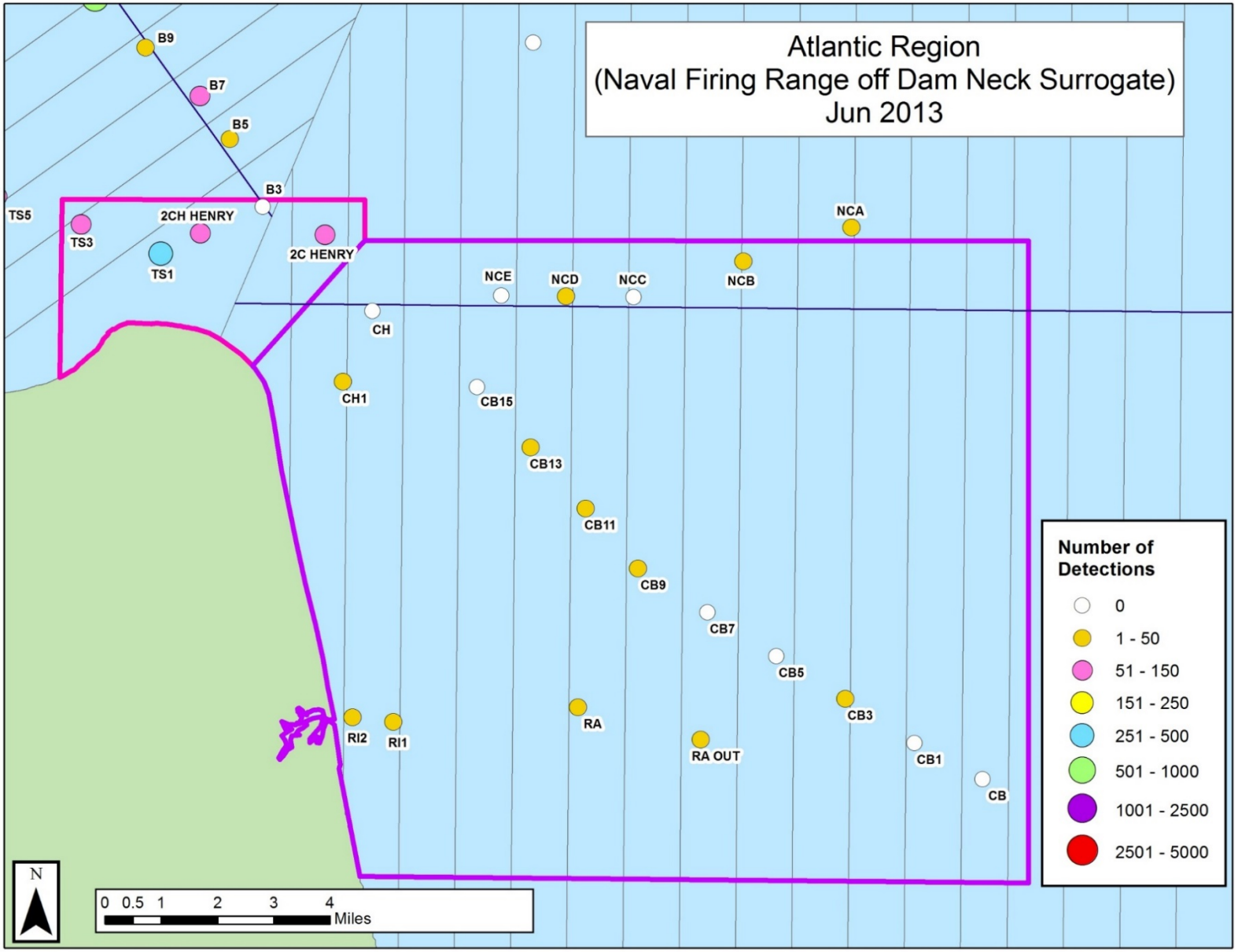

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Jan 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCB
NCE
NCD
NCC
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

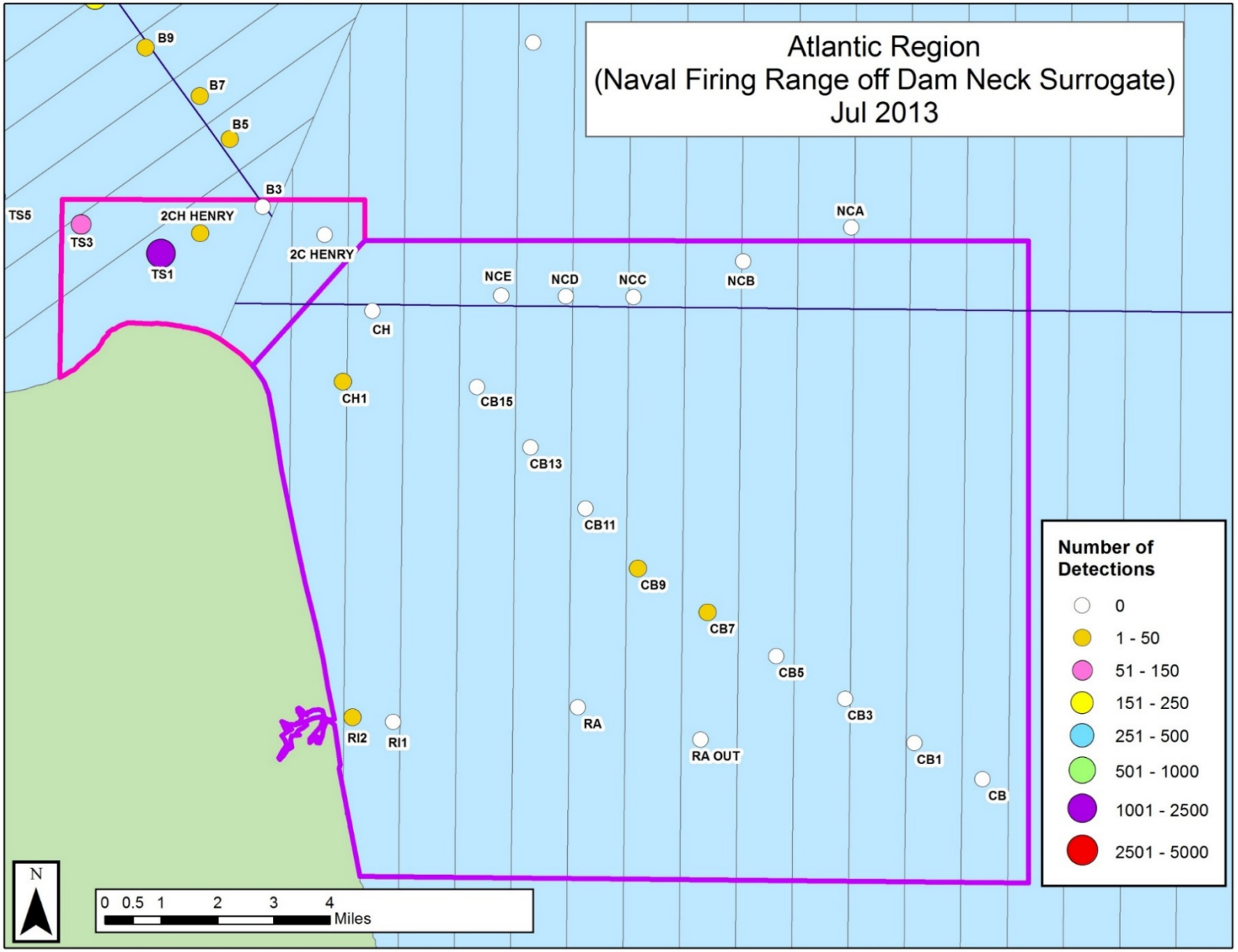

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Feb 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCB
NCE
NCD
NCC
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

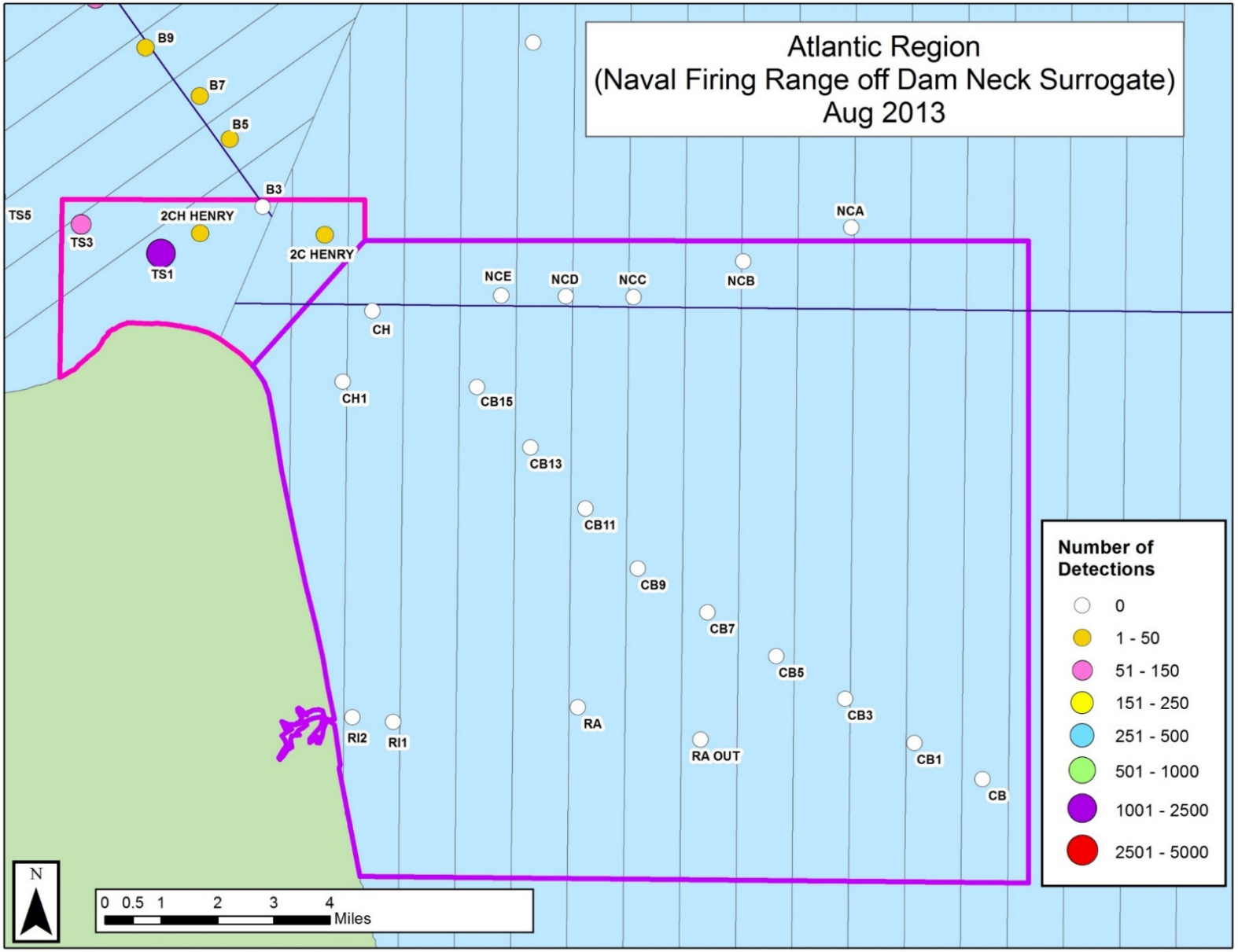

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Mar 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCB
NCE
NCD
NCC
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

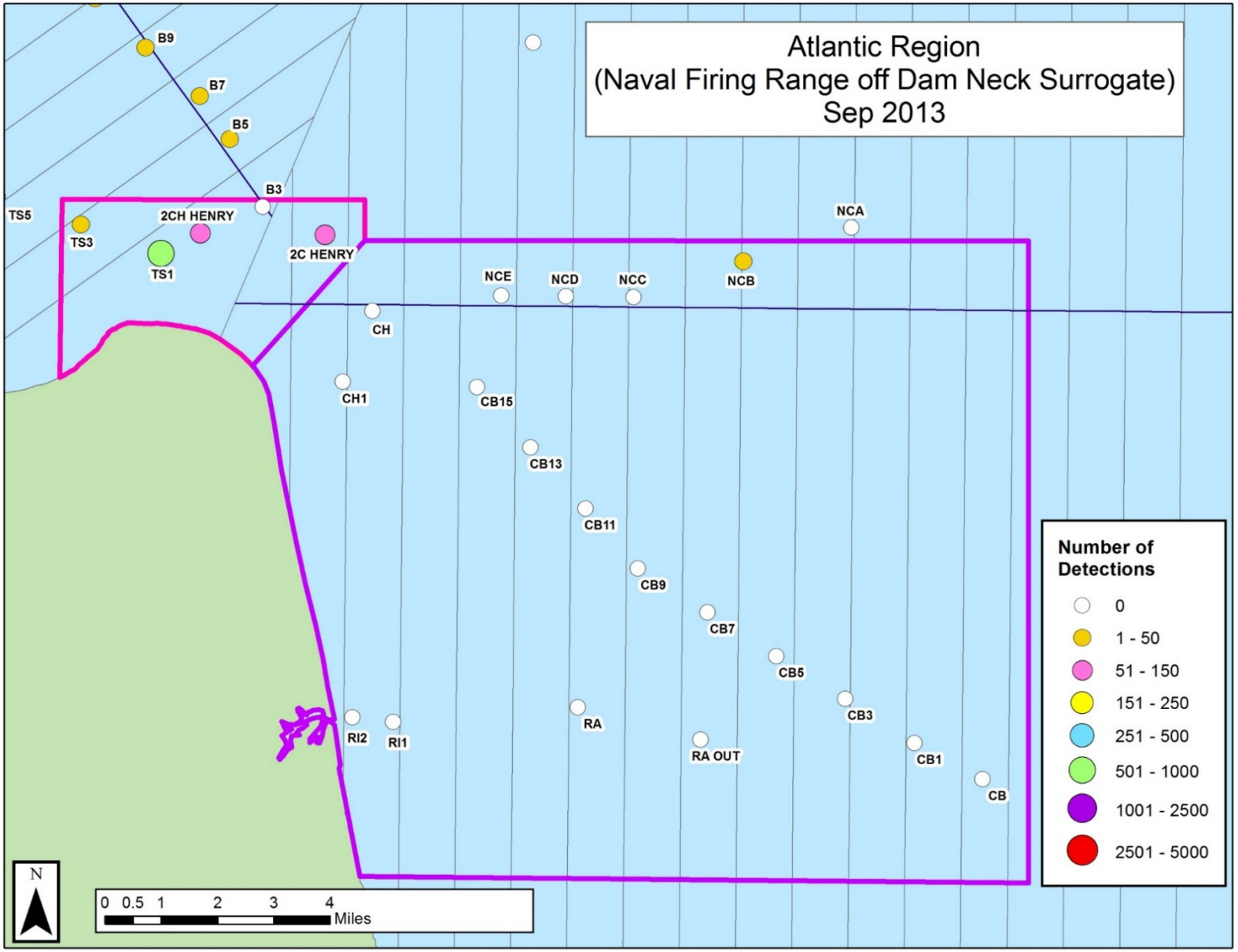

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Apr 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCB
NCE
NCD
NCC
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

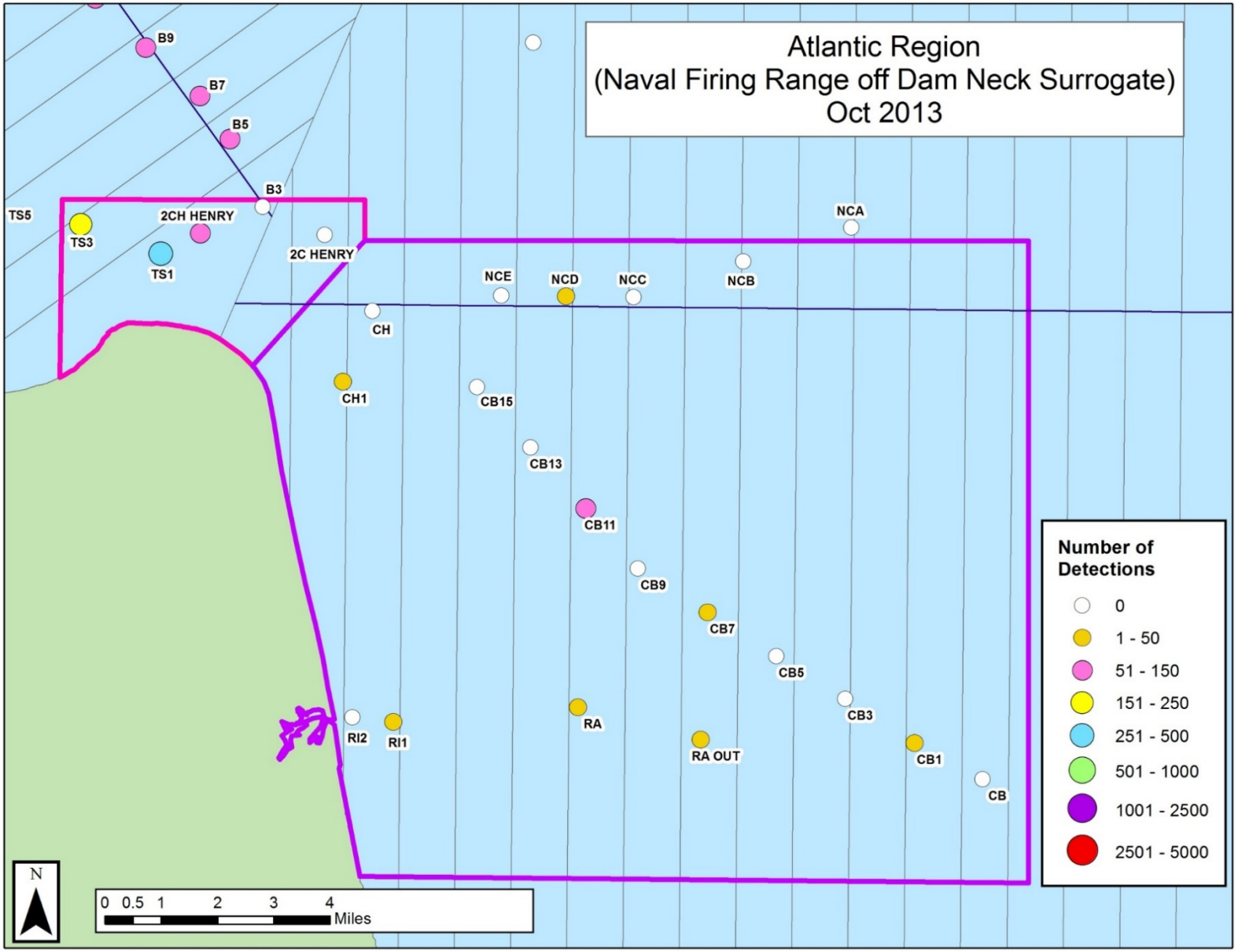

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
May 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCB
NCE
NCD
NCC
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

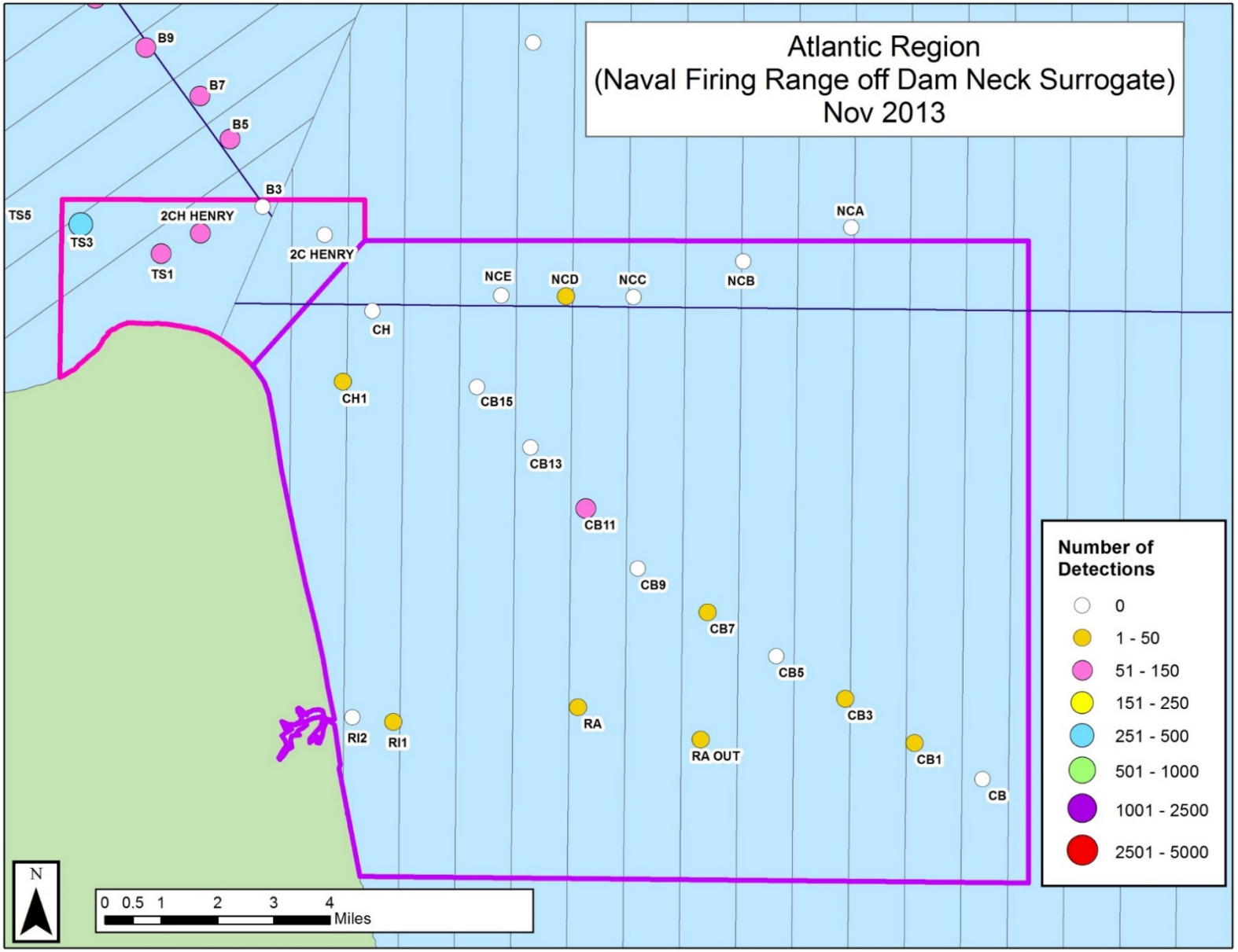

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Jun 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCB
NCE
NCD
NCC
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

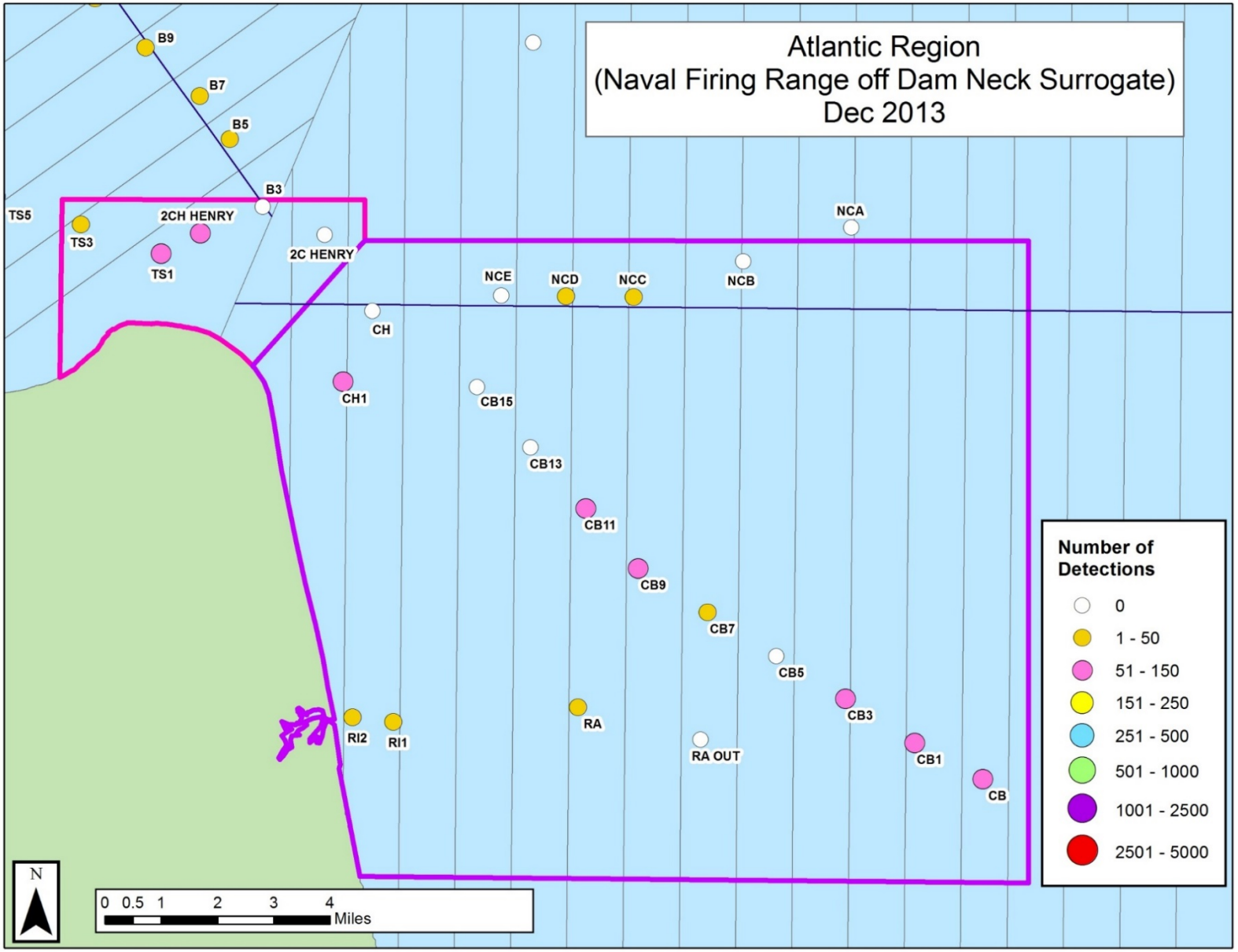

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Jul 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCE
NCD
NCC
NCB
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

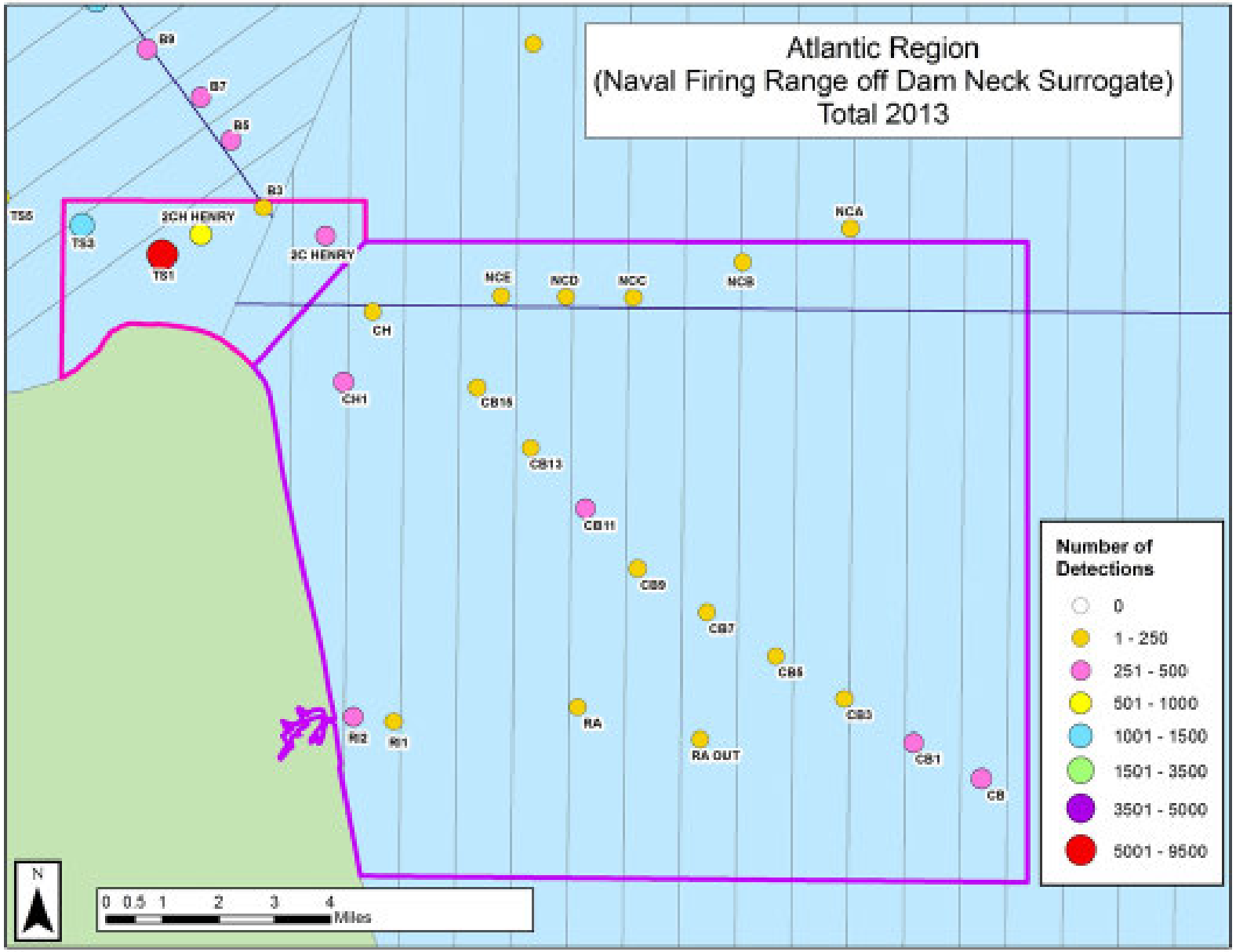

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Aug 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCE
NCD
NCC
NCB
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

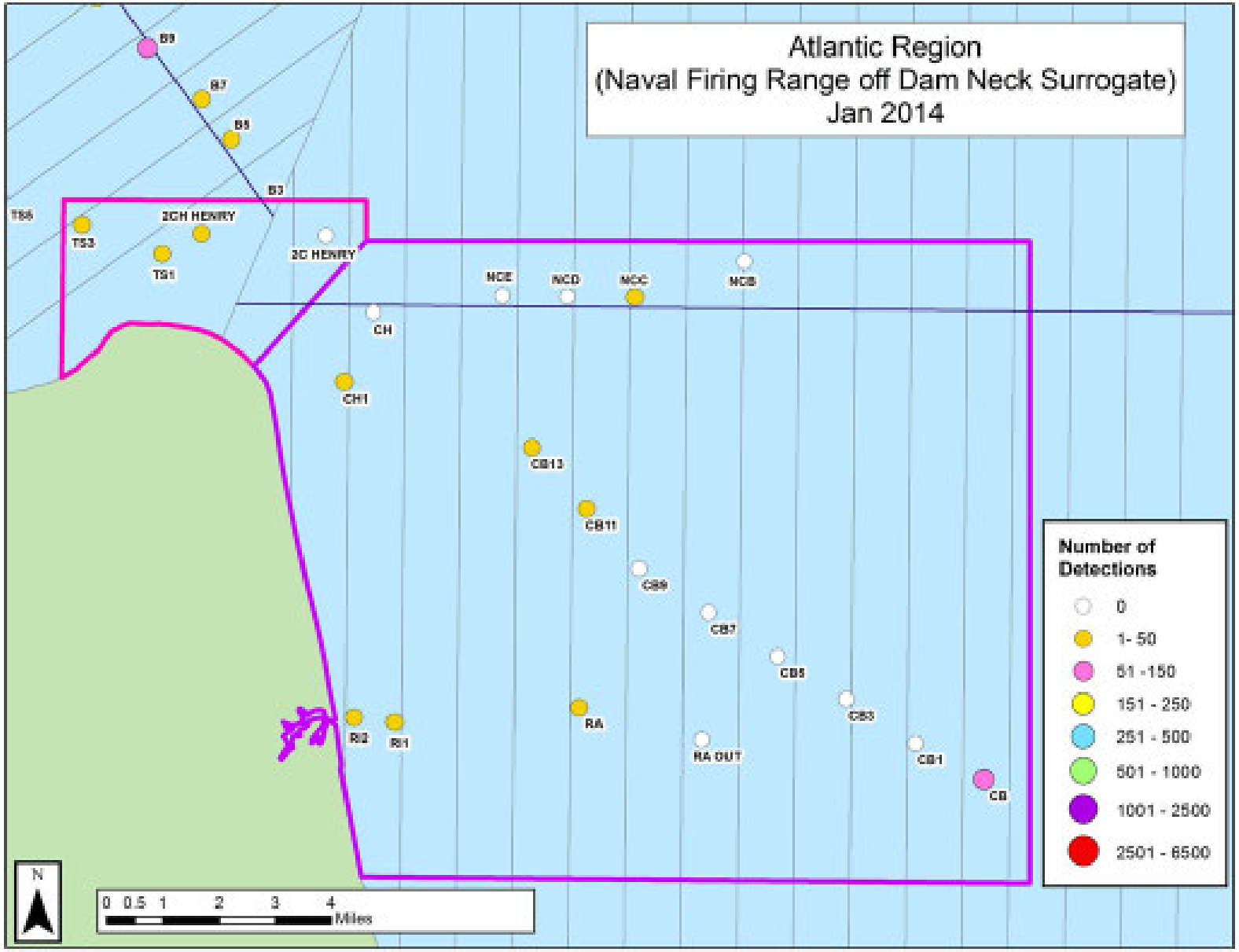

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Sep 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCB
NCE
NCD
NCC
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

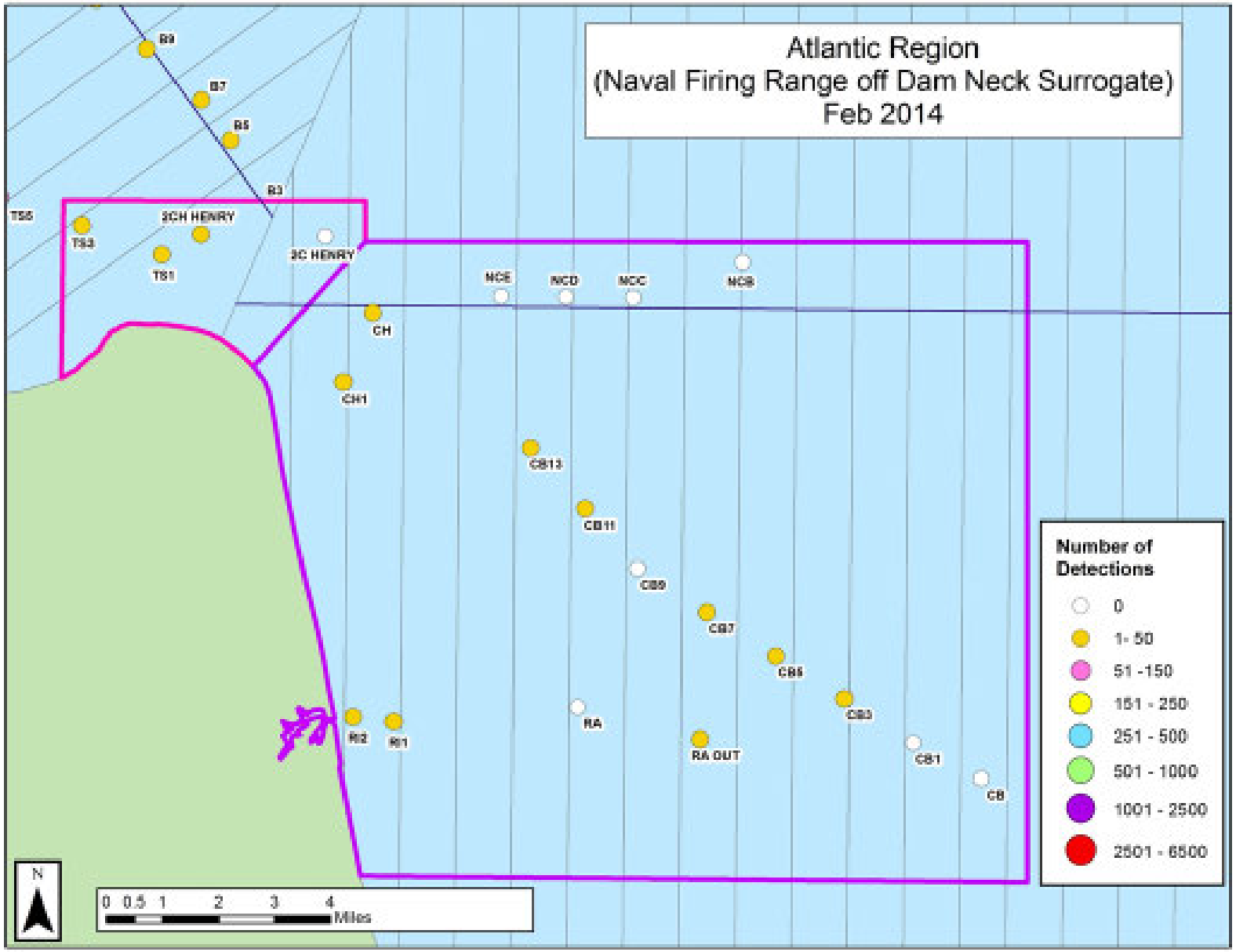

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Oct 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCE
NCD
NCC
NCB
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

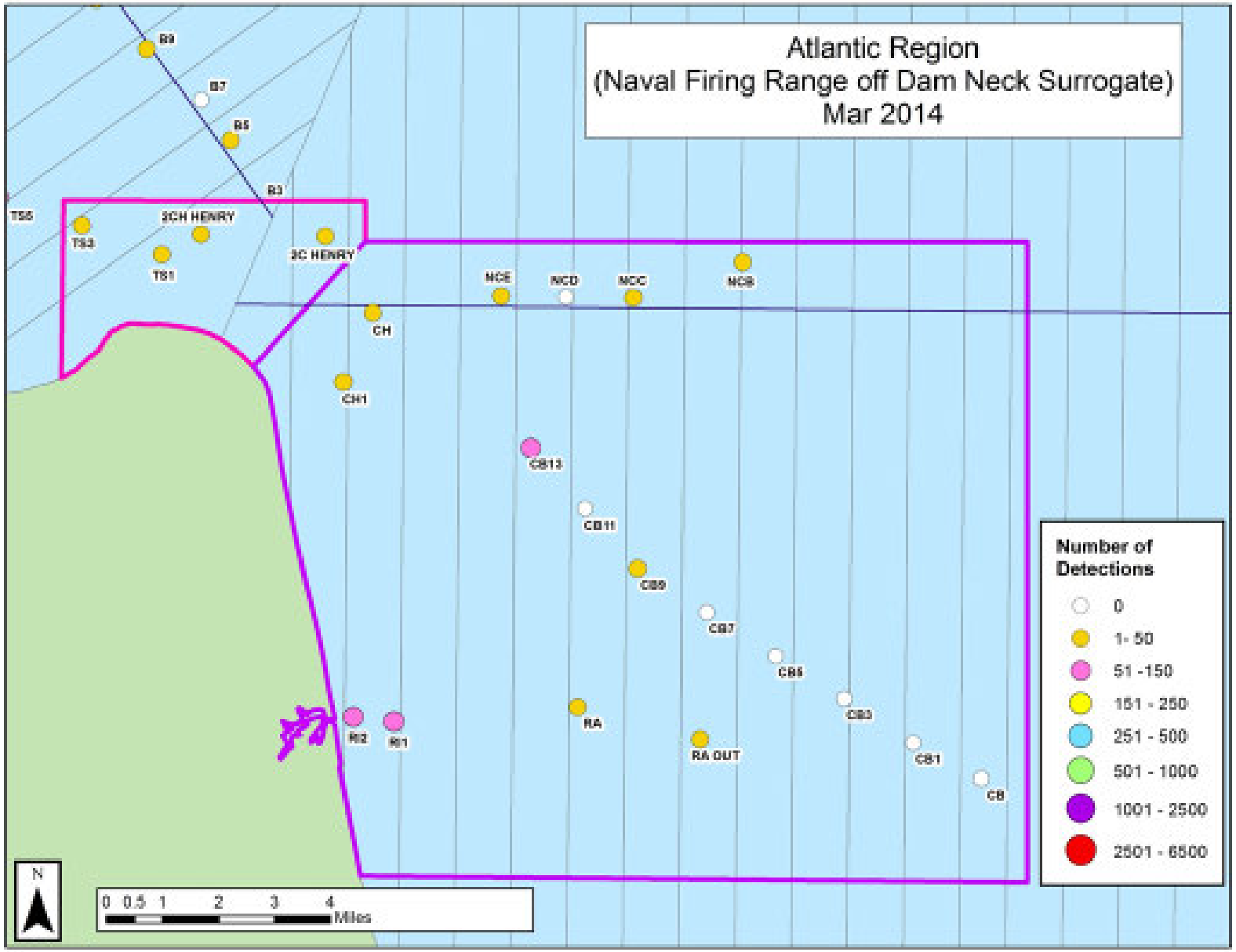

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Nov 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCE
NCD
NCC
NCB
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

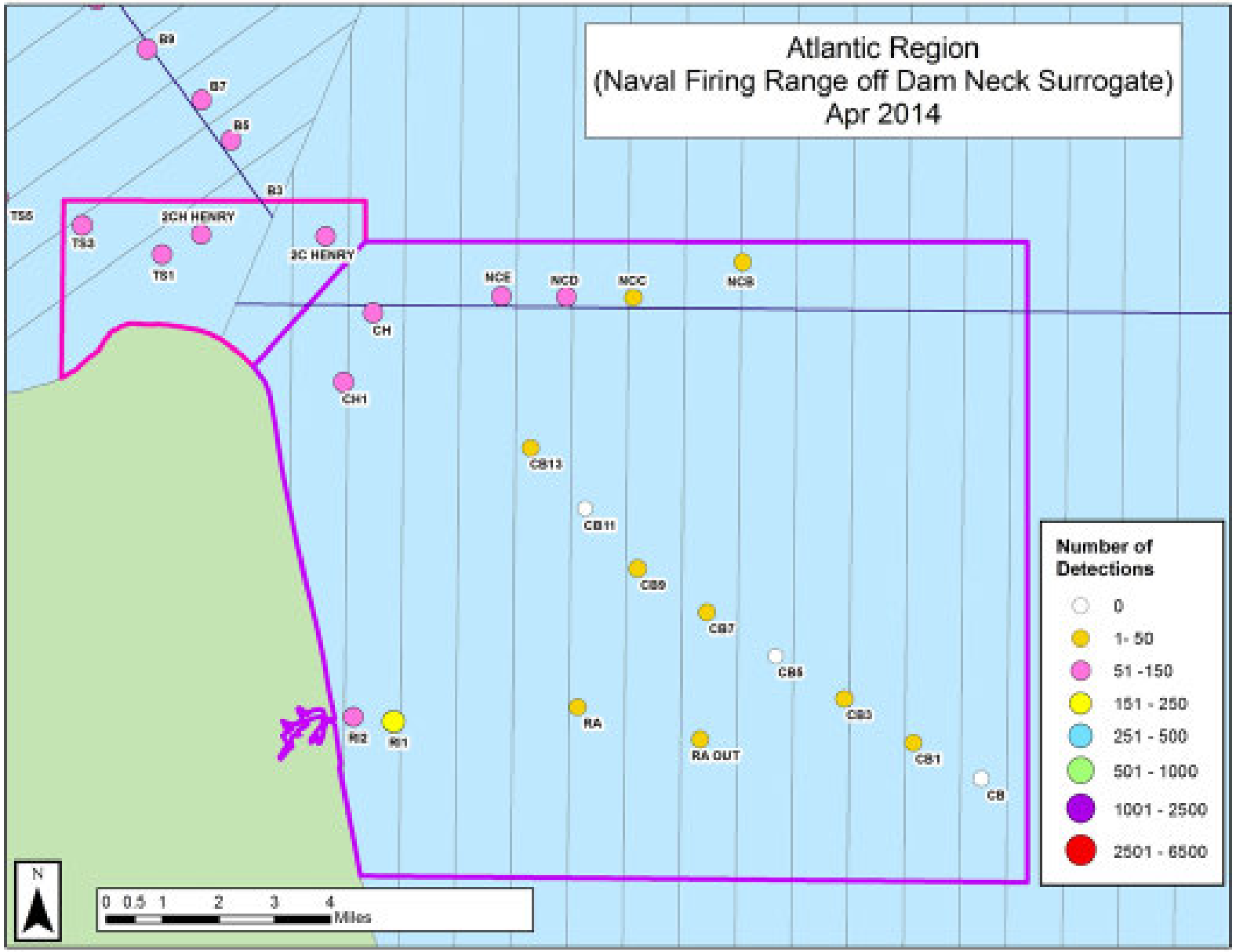

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Dec 2013
B9
B7
B5
B3
TS5
TS3
TS1
2CH HENRY
2C HENRY
NCA
NCB
NCE
NCD
NCC
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
0
1 - 50
51 - 150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
N
0 0.5 1 2 3 4
Miles

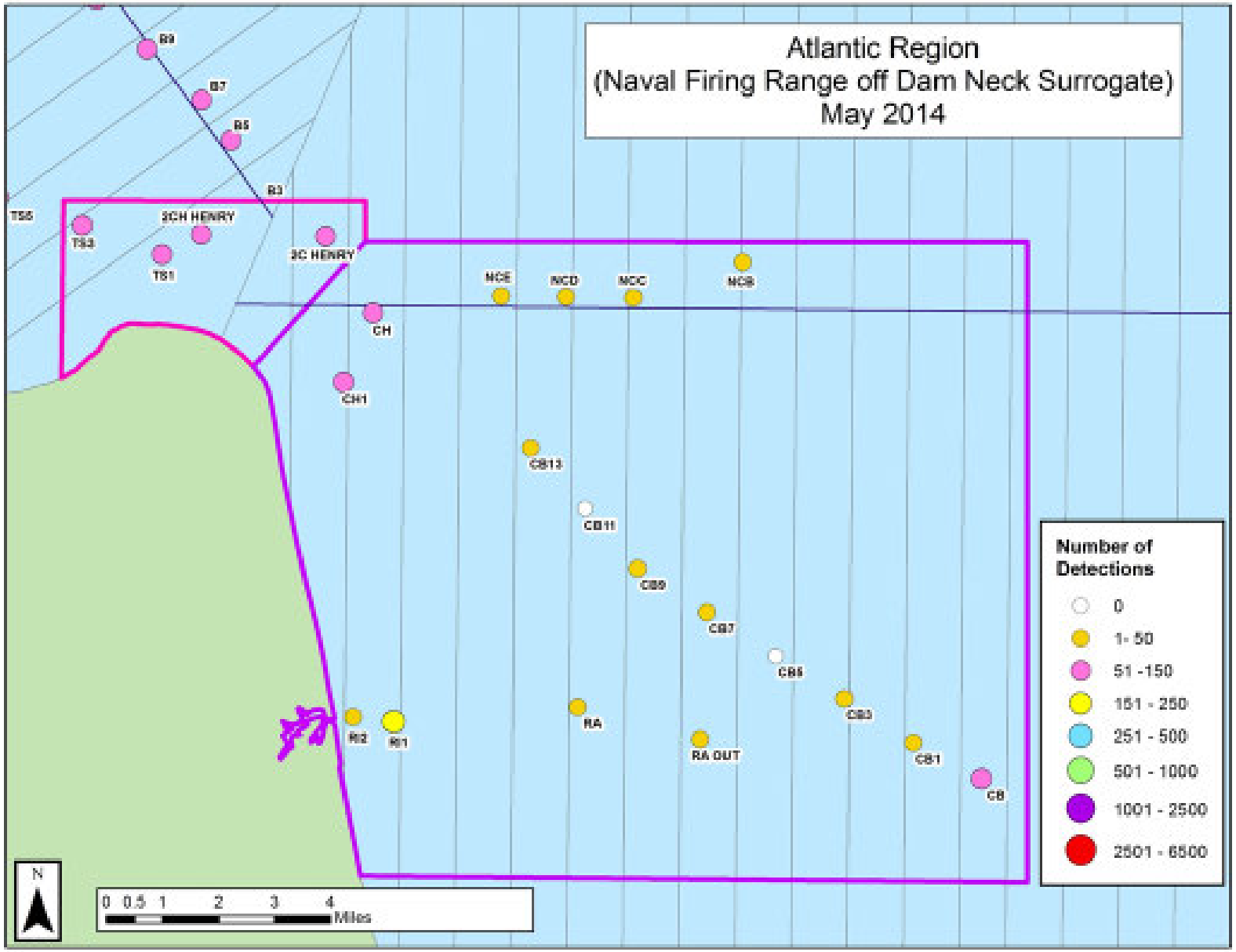

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Total 2013
B9
B7
B5
B3
TS5
TS3
TS1
3CH HENRY
3C HENRY
NCE
NCD
NCC
NCB
NCA
CH
CH1
CB15
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
N
0 0.5 1 2 3 4
Miles
Number of Detections
0
1 - 250
251 - 500
501 - 1000
1001 - 1500
1501 - 3500
3501 - 5000
5001 - 9500

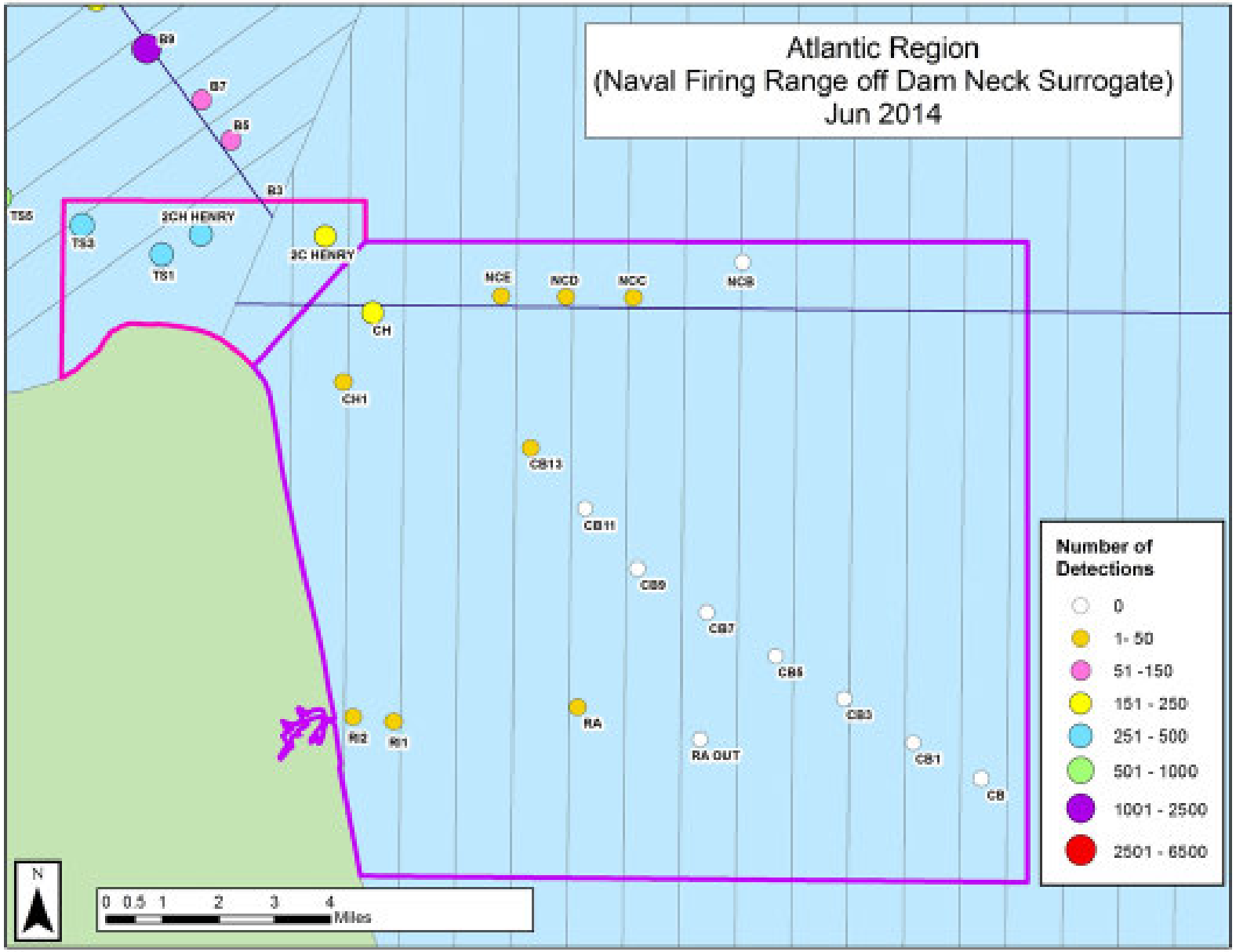

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Jan 2014
B9
B7
B5
B3
TS6
TS3
2CH HENRY
TS1
2C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

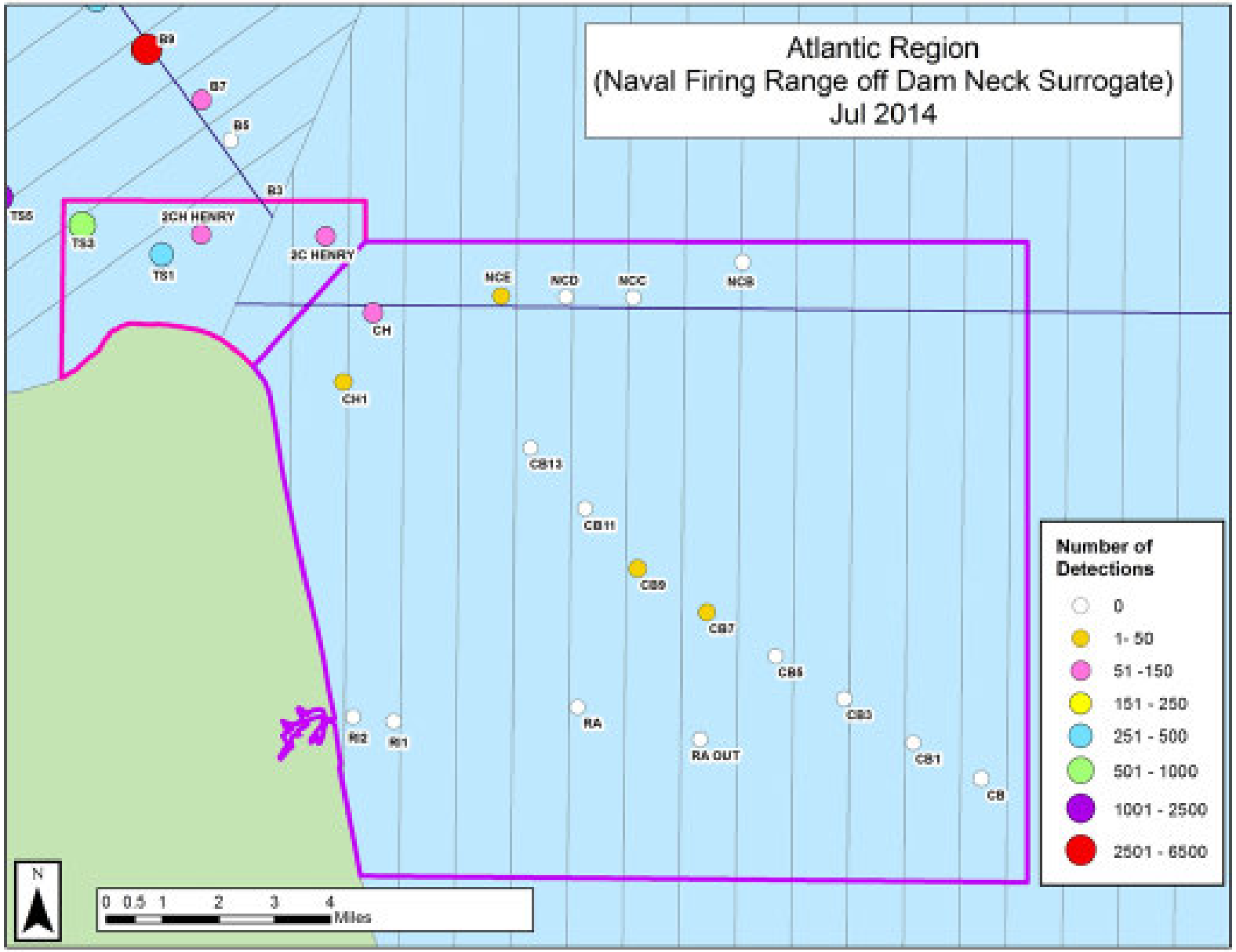

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Feb 2014
B9
B7
B5
B3
TS5
3CH HENRY
TS3
TS1
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

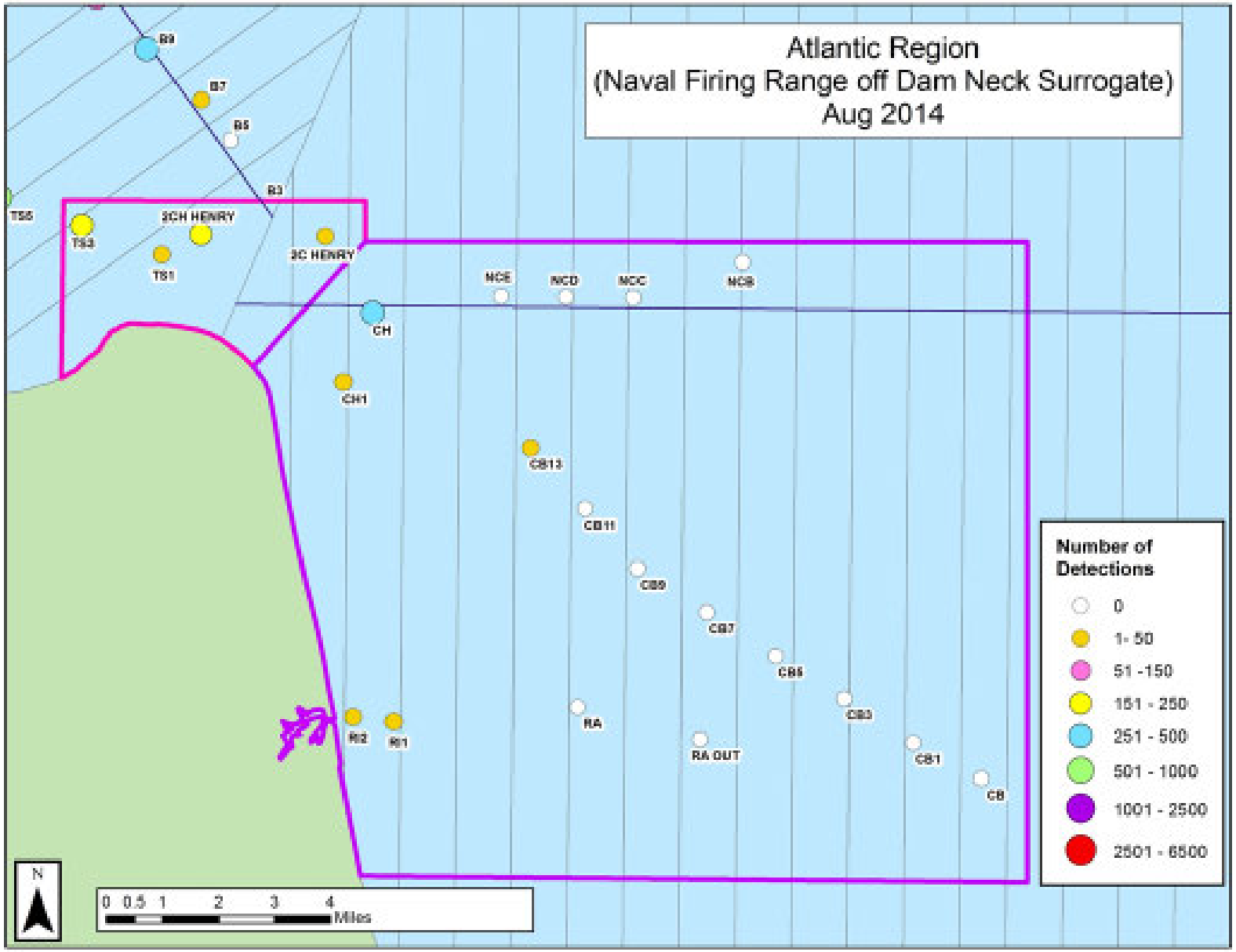

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Mar 2014
R9
R7
R5
R3
TS5
3CH HENRY
TS3
TS1
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles

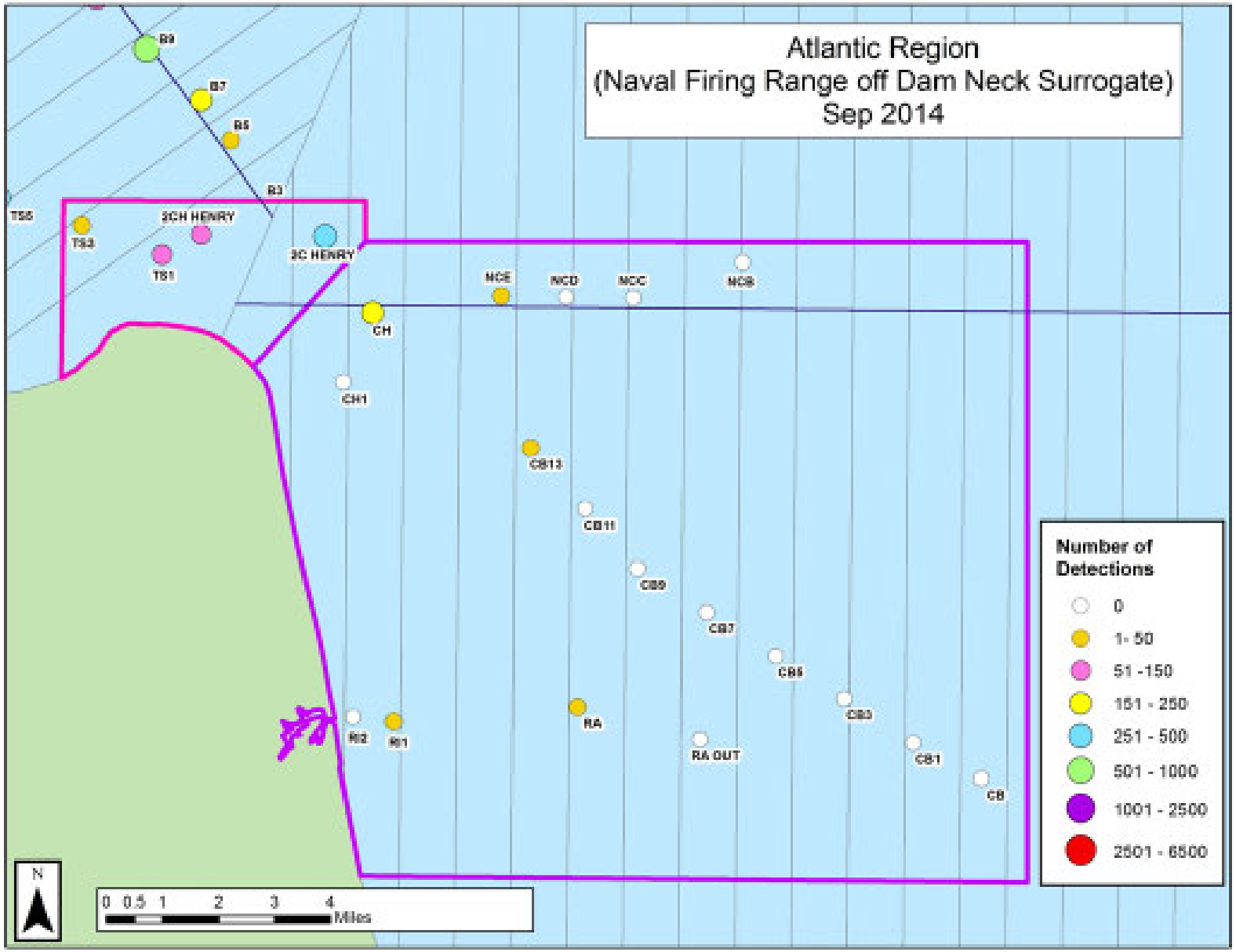

Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Apr 2014
B9
B7
B5
B3
TS5
TS3
TS1
3CH HENRY
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
May 2014
B9
B7
B5
B3
TS5
TS3
TS1
3CH HENRY
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Jun 2014
R9
B7
R5
R3
TS5
TS3
3CH HENRY
TS1
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Jul 2014
B9
B7
B5
B3
TS5
3CH HENRY
TS3
TS1
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Aug 2014
B9
B7
B5
B3
TS5
3CH HENRY
TS3
TS1
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Sep 2014
B9
B7
B5
B3
TS5
3CH HENRY
TS3
TS1
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
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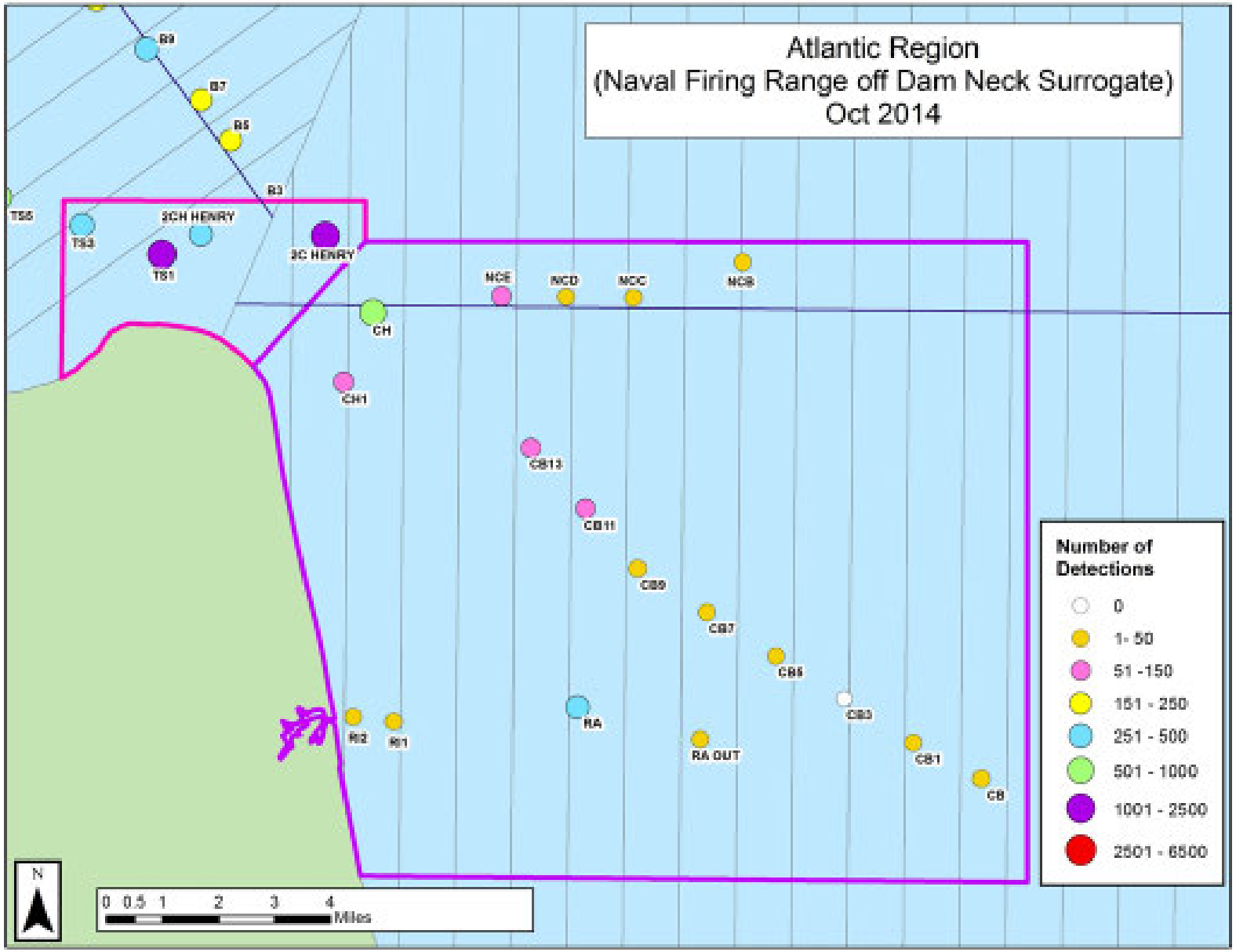
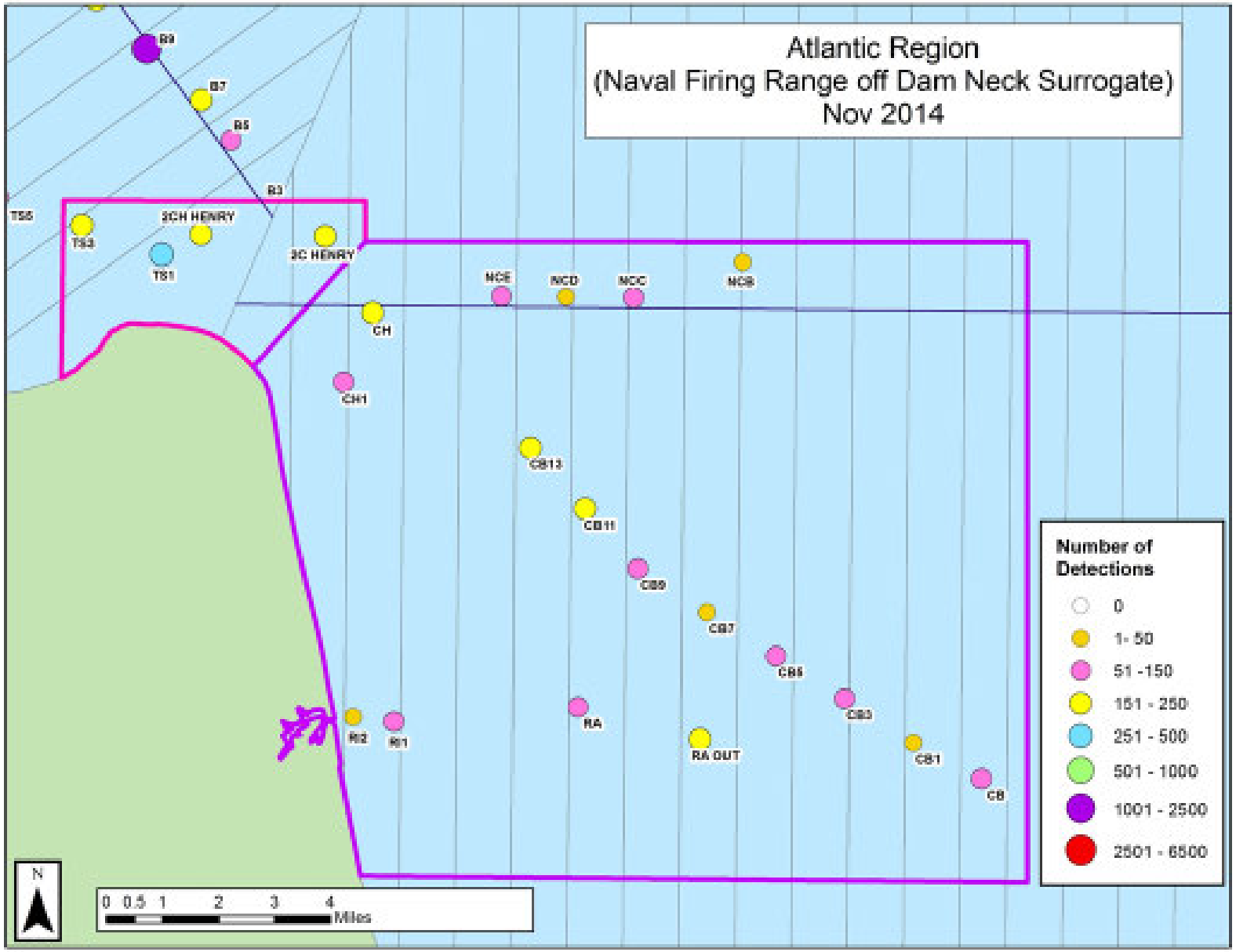
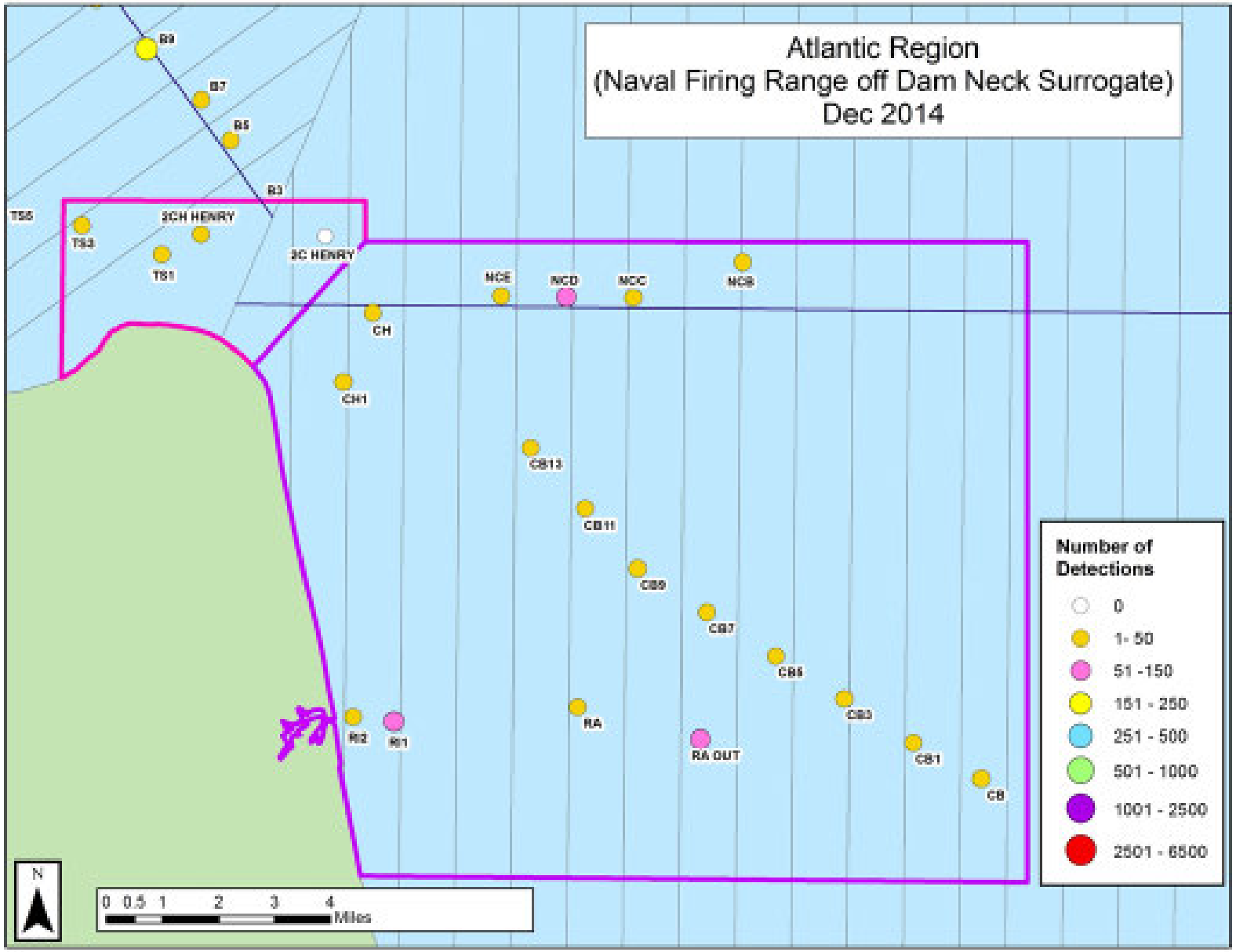
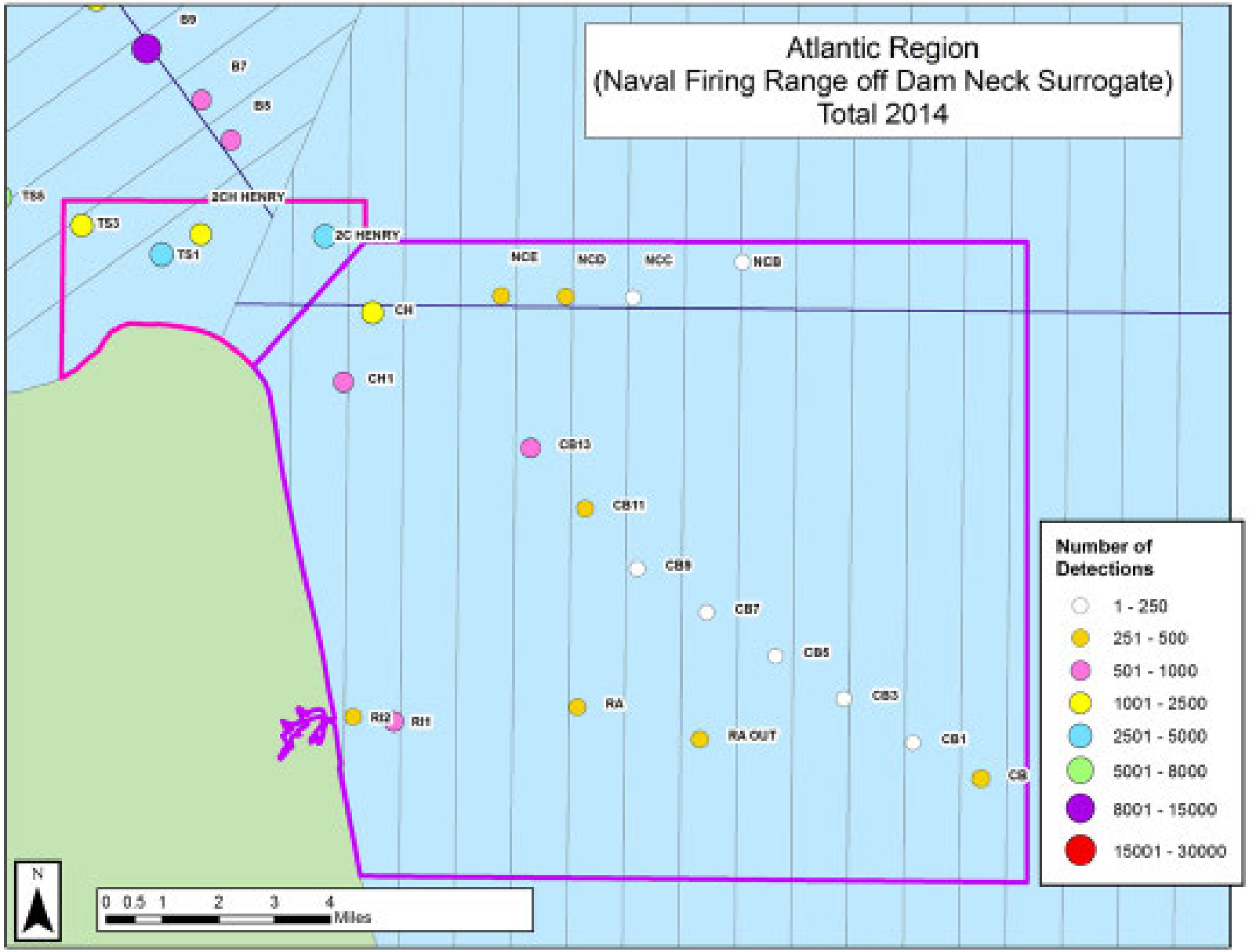
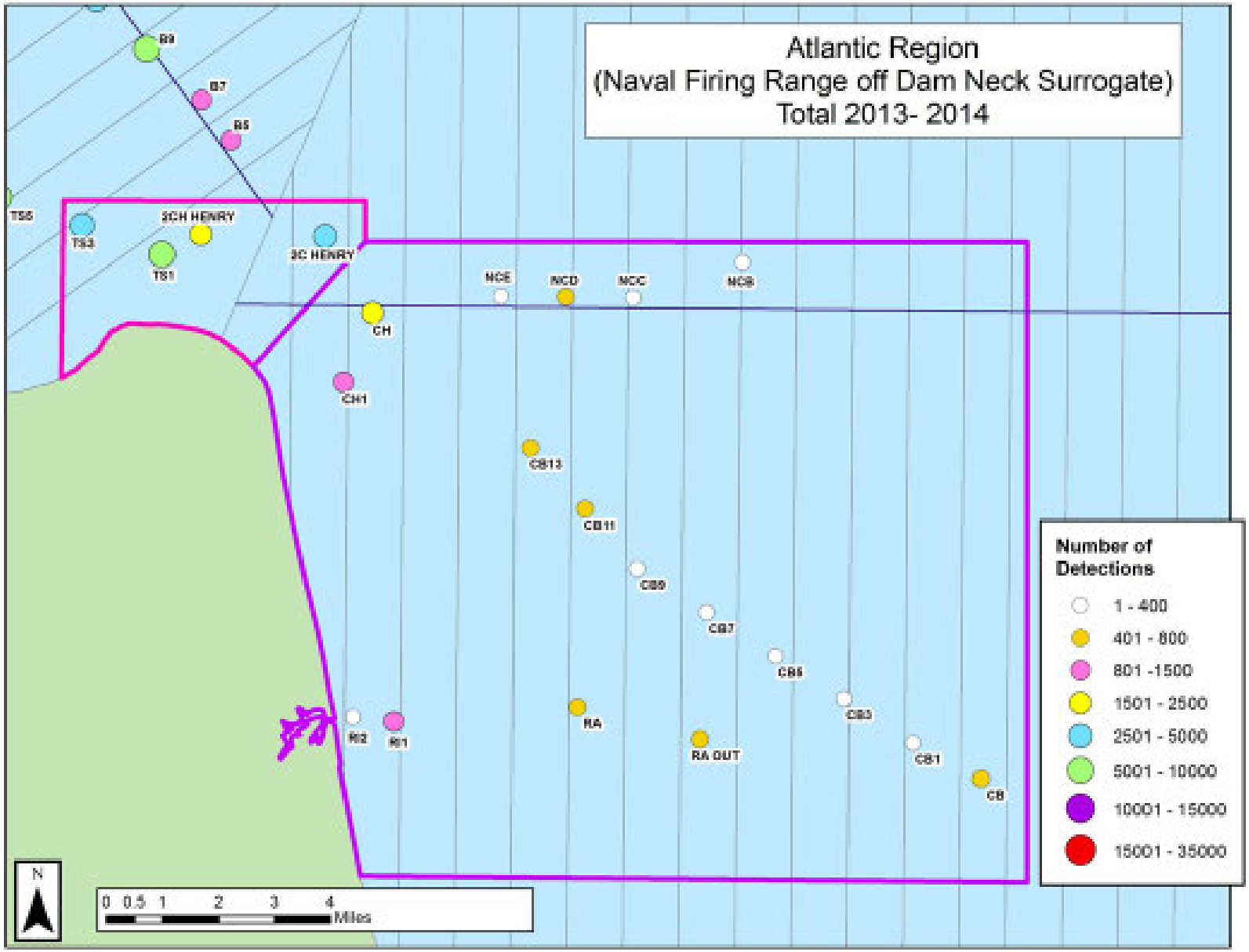
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Oct 2014
B9
B7
B5
B3
TS5
TS3
TS1
3CH HENRY
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Nov 2014
R9
B7
R5
R3
TS5
3CH HENRY
TS3
TS1
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Dec 2014
R9
B7
B5
R3
TS5
3CH HENRY
TS3
TS1
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
0
1- 50
51 -150
151 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 6500
N
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Total 2014
B9
B7
B5
TS5
2CH HENRY
TS3
TS1
2C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
RI2
RI1
Number of Detections
1 - 250
251 - 500
501 - 1000
1001 - 2500
2501 - 5000
5001 - 8000
8001 - 15000
15001 - 30000
N
0 0.5 1 2 3 4
Miles


Atlantic Region
(Naval Firing Range off Dam Neck Surrogate)
Total 2013- 2014
B9
B7
B5
TS5
TS3
3CH HENRY
TS1
3C HENRY
NCE
NCD
NCC
NCB
CH
CH1
CB13
CB11
CB9
CB7
CB5
CB3
CB1
CB
RA
RA OUT
R2
R1
Number of Detections
1 - 400
401 - 800
801 -1500
1501 - 2500
2501 - 5000
5001 - 10000
10001 - 15000
15001 - 35000
N
0 0.5 1 2 3 4
Miles

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10. TABLE APPENDIX

Summary of monitoring for sonic-tagged sturgeon, January 2014–December 2014

Note: Block colors indicate the site's status during a given period: white denotes the site was not monitored, green denotes the receiver was fully functional, yellow indicates that data may be missing and red denotes that a broken receiver was at the location during some of the monitoring period. The number in the month columns is the date of maintenance. An R following this date denotes that the receiver was retrieved, D denotes deployment, B denotes broken unknown cause, W receiver wet internally, C indicates clock failure and USCG means that the buoy was replaced by the USCG and the receiver removed. The 10/1 in the September column indicates the receiver was read on October 1. Abbreviations are as follows. For regions: Pam. is Pamunkey, Chick. is Chickahominy, Eliz. is Elizabeth, and Ches. is Chesapeake and for military zones; NW/Ch. is Naval Weapons/Cheatham Annex, NSN is Naval Station Norfolk and Range Sur. is the surrogate for the Naval Firing Range Surrogate off of Dam Neck

Receiver Site	Region	Military zone	1st trip 2013	2nd trip 2013	3rd trip 2013	4th trip 2013	5th trip 2013	6th trip 2013	7th trip 2013	8th trip 2013	9th trip 2013	10th trip 2013	11th trip 2013	12th trip 2013	13th trip 2013
CB	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/8/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/2/2013	11/22/2013LD	12/13/2013
CB1	Atlantic	Range Sur.	12/4/2012	1/8/2013LD	2/15/2013	3/15/2013	4/8/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/2/2013	11/22/2013	12/13/2013
CB11	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/21/2013	11/22/2013	12/13/2013
CB13	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/30/2013	5/14/2013	6/12/2013	7/29/2013RD	8/13/2013	9/20/2013LD10/12	10/21/2013RCD	11/22/2013	12/13/2013RCD
CB15	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013L	not deployed								
CB3	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/8/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/2/2013	11/22/2013	12/13/2013
CB5	Atlantic	Range Sur.		1/4/2013	2/15/2013	3/15/2013L	3/15/2013D	4/8/2013	5/14/2013	7/29/2013	8/13/2013	9/20/2013	10/2/2013	11/22/2013	12/13/2013
CB7	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013L	3/15/2013	4/8/2013D	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013	10/21/2013	11/22/2013	12/13/2013
CB9	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/14/2013	6/12/2013	7/29/2013	7/29/2013	9/20/2013	10/21/2013RC	11/22/2013D	12/13/2013
RA	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013RD	4/8/2013	5/14/2013	6/12/2013	7/23/2013L	8/27/2013	9/19/2013D	10/21/2013	11/22/2013RCD	12/15/2013
RA outside	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013	3/15/2013RD	4/8/2013	5/14/2013	6/12/2013	7/23/2013	8/27/2013	9/19/2013	10/21/2013	11/22/2013	12/13/2013
RI1	Atlantic	Range Sur.	1/4/2013	1/8/2013	2/15/2013	3/15/2013R	3/15/2013D	4/8/2013	5/14/2013	6/12/2013	7/23/2013	8/27/2013L	9/19/2013D	10/21/13RWD	12/15/2013RWD
RI2	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/15/2013L	3/15/2013D	4/8/2013	5/14/2013	6/12/2013	7/23/2013L		9/19/2013D	10/21/2013RWD	11/22/2013	12/15/2013RCD
CH	Atlantic	Range Sur.	12/4/2012	1/8/2013	2/17/2013		4/17/2013	5/15/2013	6/25/2013	7/29/2013L			10/22/2013D	11/22/2013RW	
CH1	Atlantic	Range Sur.	12/4/2012	1/4/2013	2/15/2013	3/15/2013	4/17/2013	5/14/2013	6/12/2013	7/29/2013	8/13/2013	9/20/2013L	10/2/2013D	11/22/2013	12/13/2013
NCA	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/15/2013	6/25/2013	7/30/2013	Not deployed				
NCB	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/8/2013	5/15/2013	6/25/2013	7/30/2013	8/13/2013	9/5/2013	10/2/2013	11/22/2013LD	12/17/2013
NCC	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/15/2013	6/25/2013	7/30/2013	8/13/2013	9/5/2013	10/2/2013	11/22/2013LD	12/17/2013
NCD	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013LD	4/8/2013	5/15/2013	6/25/2013	7/30/2013	8/13/2013	9/5/2013	9/20/2013RB	10/2/2013D	11/22/2013
NCE	Atlantic		12/4/2012	1/8/2013	2/15/2013	3/15/2013	4/8/2013	5/15/2013	6/25/2013	7/30/2013	8/13/2013	9/5/2013	10/2/2013	11/22/2013LD	12/17/2013
2CH	Ches. Bay	Fort Story	12/4/2012	1/8/2013	2/19/2013	3/15/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013	8/27/2013	9/20/2013	10/22/2013	11/22/2013	12/17/2013
TS1	Ches. Bay	Fort Story	12/4/2012	1/8/2013	2/19/2013	3/15/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013	8/27/2013	9/20/2013	10/22/2013	11/25/2013	12/17/2013
TS3	Ches. Bay	Fort Story	12/4/2012	1/8/2013	2/19/2013	3/15/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013	8/30/2013	9/20/2013	10/22/2013	11/25/2013	12/17/2013
B3	Ches. Bay	Fort Story	12/4/2012	1/8/2013	2/17/2013	3/29/2013L	not deployed								
2C HENRY	Atlantic	Fort Story	12/4/2012	1/8/2013		3/29/2013LD	4/17/2013	5/15/2013	6/18/2013	6/24/2013	7/29/2013	8/27/2013	9/20/2013	10/22/13USCGD	11/22/2013RW
CBBT4	Ches. Bay	Little Creek		1/9/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013	8/30/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
CBBT5	Ches. Bay	Little Creek		1/9/2013	2/19/2013	3/28/2013	4/30/2013	5/15/2013	6/24/2013	7/30/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
LC1	Ches. Bay	Little Creek	12/4/2012	1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
LC2	Ches. Bay	Little Creek		1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
TS11	Ches. Bay	Little Creek	12/4/2012	1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
TS7	Ches. Bay	Little Creek	12/4/2012	1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013	11/25/2013	12/17/2013	1/14/2014
TS9	Ches. Bay	Little Creek	12/4/2012	1/8/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/25/2013	7/29/2013	8/27/2013	10/1/2013L	10/22/2013D	11/25/2013	12/17/2013
10N	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013	4/30/2013	5/15/2013	6/24/2013	7/29/2013	8/30/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
11N	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013/R	not deployed								
CBBT1	Ches. Bay			1/9/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013	8/30/2013	10/1/2013	10/22/2013	11/25/2013RBD	12/17/2013	1/14/2014
LS	Ches. Bay			1/8/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013L	7/29/2013D	8/2/2013R	9/20/2013D	10/1/2013	11/25/2013	12/17/2013
CBBT2	Ches. Bay			1/9/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013	7/30/2013R			10/1/2013D	11/25/2013	12/17/2013
CBBT3	Ches. Bay			1/9/2013	2/19/2013	3/28/2013	4/17/2013	5/15/2013	6/24/2013L	7/29/2013D	8/30/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013

Receiver Site	Region	Military zone	1st trip 2013	2nd trip 2013	3rd trip 2013	4th trip 2013	5th trip 2013	6th trip 2013	7th trip 2013	8th trip 2013	9th trip 2013	10th trip 2013	11th trip 2013	12th trip 2013	13th trip 2013
CBBT7	Ches. Bay		not deployed	not deployed	not deployed	3/29/2013	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/30/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
TS5	Ches. Bay		12/4/2012	1/8/2013	2/19/2013	3/15/2013	4/17/2013	5/15/2013	6/25/2013	7/30/2013	8/27/2013	9/20/2013	10/22/2013LD	11/25/2013	12/17/2013
B11	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013L	4/17/2013D	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
B13	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013LD	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013
B15	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/25/2013	12/17/2013RD
B5	Ches. Bay		12/4/2012	1/8/2013	2/17/2013	3/29/2013LD	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/22/2013	12/17/2013
B7	Ches. Bay		12/4/2012	1/8/2013	2/15/2013L		4/17/2013D	5/15/2013	6/24/2013	7/29/2013	8/30/2013	10/1/2013	10/22/2013	11/22/2013	12/17/2013
B9	Ches. Bay		12/4/2012	1/8/2013	2/15/2013	3/29/2013	4/17/2013	5/15/2013	6/24/2013	7/29/2013	8/27/2013	10/1/2013	10/22/2013	11/22/2013	12/17/2013
NH5	James River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	not deployed			
NN 1ER FWS	James River	NSN	not deployed	not deployed	not deployed	not deployed	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN 3ER NOAA SP	James River	NSN	not deployed	not deployed	not deployed	not deployed	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN DANGER FWS	James River	NSN	not deployed	not deployed	not deployed	not deployed	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN R22 NOAA SP	James River	NSN	not deployed	not deployed	not deployed	not deployed	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN2	James River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NN5	James River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013RD	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013L	10/17/2013D	11/6/2013	12/6/2013
NN8	James River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH8	Eliz. River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH10	Eliz. River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH12	Eliz. River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH14	Eliz. River	NSN	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
APMI	Eliz. River	Eliz. River	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH29	Eliz. River	Eliz. River	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH32	Eliz. River	Eliz. River	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
NH36	Eliz. River	Eliz. River	12/7/2012	1/9/2013	2/12/2013	3/4/2013	4/3/2013	5/13/2013	6/28/2013	7/18/2013	8/21/2013	9/5/2013	10/17/2013	11/6/2013	12/6/2013
Y PAGE	York River	NW/Ch.	12/6/2012	1/7/2013	2/11/2013	3/5/2013	4/23/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/18/2013	12/4/2013
Y WAT	York River	NW/Ch.	12/7/2012	1/4/2013	1/31/2013	3/13/2013	4/18/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/30/2013	11/18/2013	12/4/2013
Y2	York River	NW/Ch.	12/6/2012	1/7/2013	2/11/2013	3/5/2013	4/23/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/18/2013	12/4/2013
Y8	York River	NW/Ch.	12/6/2012	1/7/2013	2/11/2013	3/5/2013	4/23/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/30/2013	11/18/2013RD	12/4/2013
Y BELL NOAA	York River			1/7/2013	2/11/2013	3/13/2013	4/23/2013	5/8/2013	6/19/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
Y12	York River		12/6/2012	1/7/2013	2/11/2013	3/5/2013	4/23/2013	5/8/2013	6/4/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
Y18 NOAA	York River		12/1/2012	1/7/2013	2/11/2013	3/13/2013	4/23/2013	5/8/2013	6/19/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
Y20 NOAA	York River				2/11/2013	3/13/2013	4/23/2013	5/8/2013	6/19/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
Y29 NOAA	York River				2/11/2013	3/13/2013	4/23/2013	5/8/2013	6/19/2013	7/3/2013	8/8/2013	9/4/2013	10/8/2013	11/12/2013	12/4/2013
PAM 360	Pam. River											9/10/2013	10/4/2013	11/5/2013	12/10/2013
PAM (b) (6) UPPER	Pam. River										8/20/2013	9/10/2013	10/4/2013	11/5/2013	12/10/2013
PAM (b) (6)	Pam. River		1/2/2013	2/4/2013	3/7/2013	4/1/2013	5/7/2013	6/6/2013	7/8/2013	8/1/2013	8/29/2013	9/10/2013	10/4/2013	11/5/2013	12/13/2013
PAM BRICK WALL	Pam. River											9/13/2013	10/4/2013	11/5/2013	12/10/2013
PAM Res.	Pam. River		1/2/2013	2/4/2013	3/7/2013	4/28/2013	5/7/2013	5/31/2013	6/6/2013	7/8/2013	8/1/2013	9/10/2013	10/4/2013	11/5/2013	12/10/2013
PAM (b) (6)	Pam. River		1/2/2013	2/4/2013	3/7/2013	4/1/2013	5/7/2013	6/6/2013	7/8/2013	8/1/2013	9/10/2013	10/4/2013	11/5/2013	12/10/2013	1/3/2014
PAM (b) (6)	Pam. River		1/2/2013	3/6/2013	3/6/2013	4/1/2013	5/7/2013	6/6/2013	7/8/2013	8/1/2013	9/9/2013	10/4/2013	11/5/2013	12/10/2013	1/3/2014

Receiver Site	Region	Military zone	1st trip 2014	2nd trip 2014	3rd trip 2014	4th trip 2014	5th trip 2014	6th trip 2014	7th trip 2014	8th trip 2014	9th trip 2014	10th trip 2014	11th trip 2014	12th trip 2014	1st trip 2015
CB	Atlantic	Range Sur.	1/31/2014RWD	2/20/14RWD	3/12/2014RWD	4/25/2014RWD	5/7/2014	6/18/2014	7/30/2014	9/2/2014LD	10/2/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB1	Atlantic	Range Sur.	1/31/2014RCD	2/20/14 RCD	3/12/2014RCD	4/25/2014RCD	5/7/2014	6/18/2014	7/30/2014	9/2/2014LD	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB11	Atlantic	Range Sur.	1/31/2014	2/20/2014	3/12/2014	buoy gone	buoy gone	6/18/2014D	7/31/2014L	9/2/2014D	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB13	Atlantic	Range Sur.	1/31/2013C	2/20/14RCD	3/12/2014	4/25/2014	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB15	Atlantic	Range Sur.	not deployed												
CB3	Atlantic	Range Sur.	1/31/2014RD	2/20/14RCD	3/12/2014	4/25/2014	5/7/2014	6/18/2014	7/30/2014 USCGRD	9/2/2014	10/9/2014LD	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB5	Atlantic	Range Sur.	1/31/2014RCD	2/20/2014	3/12/2014RWD	4/25/2014RWD	5/7/2014	6/18/2014	7/30/2014	9/2/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB7	Atlantic	Range Sur.	1/31/2014RCD	2/20/2014RCD	3/12/14RCD	4/25/2014RCD	5/7/2014	6/18/2014	7/30/2014	9/2/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
CB9	Atlantic	Range Sur.	1/31/2014RCD	2/20/2014	3/12/2014	4/25/2014	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
RA	Atlantic	Range Sur.	1/26/2014	2/20/2014	not retrievable	4/25/2014	5/7/2014	6/18/2014	7/30/2014 USCGRD	9/2/2014	10/9/2014	10/20/2014	11/10/2014	12/28/2014	1/11/2015
RA outside	Atlantic	Range Sur.	1/26/2014RWD	2/20/2014	not retrievable	4/25/2014	5/7/2014	6/18/2014	7/30/2014	9/2/2014	10/9/2014	10/20/2014	11/10/2014	12/28/2014	1/11/2015
RI1	Atlantic	Range Sur.	1/26/2014	2/20/2014	not retrievable	4/25/2014	5/7/2014	6/18/2014	7/30/2014 USCGRD	9/2/2014	10/9/2014	10/20/2014	11/10/2014	12/18/2014	1/11/2015
RI2	Atlantic	Range Sur.	1/26/2014RCD	2/20/2014	not retrievable	4/25/2014	5/7/2014	6/18/2014LD	7/30/2014	9/2/2014	10/9/2014	10/20/2014	11/10/2014	12/28/2014LD	1/11/2015
CH	Atlantic	Range Sur.		2/27/2014	3/12/2014	4/2/2014	5/7/2014	6/18/2014	7/31/2014	9/3/2014	10/9/2014	10/9/2014	11/10/2014	12/15/2014	1/11/2015
CH1	Atlantic	Range Sur.	1/14/2014	2/27/2014	3/12/2014	4/2/2014	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/9/2014	11/10/2014	12/20/2014	1/11/2015	
NCA	Atlantic		not deployed												
NCB	Atlantic		1/31/2014RCD	2/20/2014RCD	3/12/2014	4/25/2014	5/21/2014	6/19/2014	7/31/2014	9/3/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
NCC	Atlantic		1/31/2014RCD	2/20/2014	3/12/2014	4/25/2014	5/21/2014	6/19/2014	7/31/2014	9/3/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
NCD	Atlantic		1/31/2014	2/20/2014	3/12/2014	4/25/2014	5/21/2014	6/19/2014	7/31/2014	9/3/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
NCE	Atlantic		1/31/2014RWD	2/20/2014	3/12/2014	4/25/2014	5/21/2014	6/19/2014RBD	7/31/2014	9/3/2014	10/9/2014	10/21/2014	11/10/2014	12/20/2014	1/11/2015
2CH	Ches. Bay	Fort Story	1/14/2014	2/27/2014	3/12/2014	4/2/2014	5/21/2014	6/19/2014			10/10/2014	10/21/2014	11/25/2014	12/15/2014	1/11/2015
TS1	Ches. Bay	Fort Story	1/14/2014	2/27/2014	3/12/2014	4/2/2014	5/21/2014	6/18/2014	7/31/2014	9/3/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
TS3	Ches. Bay	Fort Story	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/7/2014	6/18/2014	7/31/2014	9/3/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B3	Ches. Bay	Fort Story	not deployed												
2C HENRY	Atlantic	Fort Story		2/27/2014D	3/12/2014	4/2/2014	5/7/2014	6/18/2014	7/31/2014	9/3/2014	10/3/2014	10/9/2014	11/10/2014	12/20/2014	1/11/2015
CBBT4	Ches. Bay	Little Creek	1/26/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/21/2014	11/25/2014	12/28/2014	1/20/2015
CBBT5	Ches. Bay	Little Creek	1/26/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/21/2014LD	11/25/2014	12/28/2014	1/20/2015
LC1	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
LC2	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
TS11	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
TS7	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
TS9	Ches. Bay	Little Creek	1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	9/22/2014	10/10/2014	11/25/2014	12/15/2014	1/20/2015
10N	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/3/2014	10/3/2014	not reachable	11/25/2014	12/15/2014	1/20/2015
11N	Ches. Bay		not deployed												
CBBT1	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014		10/3/2014	11/25/2014	12/28/2014	1/20/2015
LS	Ches. Bay		1/14/2014	1/14/2014	2/27/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	not reachable	10/3/2014	11/25/2014	12/28/2014	1/20/2015
CBBT2	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014		10/3/2014	11/25/2014	12/28/2014	1/20/2015
CBBT3	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014		10/3/2014	11/25/2014	12/28/2014	1/20/2015
CBBT7	Ches. Bay		1/14/2014	2/27/2014	4/2/2014LD	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014		10/3/2014	11/25/2014	12/28/2014	1/20/2015LD
TS5	Ches. Bay		1/26/2014	2/27/2014	4/2/2014	4/24/2014	4/24/2014	5/7/2014	6/18/2014	7/23/2014	9/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B11	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/7/2014	6/18/2014	7/23/2014 USCGRD	9/2/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B13	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014 USCGRD	9/2/2014	10/3/2014	not reachable	11/25/2014	12/15/2014	1/20/2015
B15	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/19/2014	7/23/2014	9/2/2014	10/3/2014	not reachable	11/25/2014	12/15/2014	1/20/2015
B5	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/21/2014	6/18/2014	7/31/2014USCGRD	9/3/2014	10/3/2014USCGRD	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B7	Ches. Bay		1/14/2014	2/27/2014RCD	buoy gone in March	4/2/2014D	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
B9	Ches. Bay		1/14/2014	2/27/2014	4/2/2014	4/24/2014	5/7/2014	6/18/2014	7/31/2014	9/2/2014	10/3/2014	10/10/2014	11/25/2014	12/15/2014	1/11/2015
NH5	James River	NSN	not deployed												

Receiver Site	Region	Military zone	1st trip 2014	2nd trip 2014	3rd trip 2014	4th trip 2014	5th trip 2014	6th trip 2014	7th trip 2014	8th trip 2014	9th trip 2014	10th trip 2014	11th trip 2014	12th trip 2014	1st trip 2015
NN 1ER FWS	James River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN 3ER NOAA SP	James River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN DANGER FWS	James River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN R22 NOAA SP	James River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN2	James River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN5	James River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NN8	James River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH8	Eliz. River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH10	Eliz. River	NSN	1/9/2014	2/6/2014	3/21/2014LD	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH12	Eliz. River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH14	Eliz. River	NSN	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
APMI	Eliz. River	Eliz. River	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH29	Eliz. River	Eliz. River	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH32	Eliz. River	Eliz. River	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
NH36	Eliz. River	Eliz. River	1/9/2014	2/6/2014	3/21/2014	4/14/2014	5/6/2014	6/5/2014	7/29/2014	8/9/2014	9/22/2014	10/17/2014	11/21/2014	12/5/2014	1/16/2015
Y PAGE	York River	NW/Ch.	1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y WAT	York River	NW/Ch.	1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y2	York River	NW/Ch.	1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y8	York River	NW/Ch.	1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y BELL NOAA	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y12	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y18 NOAA	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y20 NOAA	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Y29 NOAA	York River		1/2/2014	2/5/2014	3/11/2014	3/29/2014	5/2/2014	6/3/2014	6/30/2014	8/13/2014	9/10/2014	10/1/2014	11/5/2014	12/3/2014	1/21/2015
Pam. 360	Pam. River		1/3/2014	2/4/2014	3/20/2014	4/10/2014	5/1/2014	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/3/2014	12/1/2014	1/6/2015
Pam. top $	Pam. River		seasonal							8/11/2014D	9/11/2014	10/6/2014	11/4/2014		
Pam. TOP 1	Pam. River		seasonal						7/26/2014D	8/12/2014	9/11/2014CRD	10/6/2014	11/4/2014		
Pam. rootball	Pam. River		seasonal							8/11/2014D	9/11/2014	10/6/2014	11/4/2014		
Pam. hickory	Pam. River		seasonal						7/21/2014D	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam. farm H2O	Pam. River		seasonal						7/21/201D	8/14/2014	9/11/2014	10/6/2014	11/4/2014		
Pam. (b) (6) upper	Pam. River		seasonal				5/1/2014D	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/4/2014		
Pam. Lower up (b) (6)	Pam. River		seasonal						7/26/2014D	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam Fossil Cliff	Pam. River		seasonal						7/26/2014D	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam. (b) (6)	Pam. River		not reachable	2/4/2014	3/20/2014	4/10/2014	5/1/2014	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/3/2014	12/1/2014	1/6/2015
Pam (b) (6) lower	Pam. River		seasonal						7/26/2014D	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam (b) (6) (b) (6)	Pam. River		seasonal								9/5/2014D	10/6/2014	11/4/2014		
Pam. poles	Pam. River		seasonal								9/15/2014D	10/6/2014	11/3/141		
Pam. Brick wall	Pam. River		seasonal				5/1/2014D	6/2/2014	7/26/2014	8/12/2014	9/11/2014	10/6/2014	11/4/2014		
Pam. Res.	Pam. River		1/3/2014	2/4/2014	3/20/2014	4/10/2014	5/1/2014	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/3/2014	12/1/2014	1/6/2015
Pam. (b) (6)	Pam. River		1/3/2014	2/4/2014	3/20/2014	4/10/2014	5/1/2014	6/2/2014	7/26/2014	8/12/2014	9/17/2014	10/6/2014	11/3/2014	12/1/2014	1/6/2015
Pam. (b) (6)	Pam. River		1/3/2014	2/4/2014	3/20/2014	4/10/2014	5/15/2014	6/2/2014	7/26/2014	8/12/2014	9/11/2014	11/7/2014	11/15/2014	12/1/2014	1/6/2015
Chick. Bridge	Chick. River		seasonal			3/13/2014	4/11/2014	5/10/2014	6/24/2014	7/31/2014		9/9/2014		12/2/2014	1/29/2015
Chick. Bridge CC side	Chick. River					3/20/2014D	4/11/2014	5/10/2014	6/24/2014	7/31/2014		9/9/2014		12/2/2014	1/29/2015